Vol. 5 OCTOBER, 1911 No. 2

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

87 MILK STREET, BOSTON, MASS.

EDITED BY THE SECRETARY

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Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Fire S-6973. Good Work of Automatic Sprinklers in Cotton Warehouses.

President Merrill says it is called the "parlor" match because of its manners,—its conversational responses are so snappy!

The Quarterly

Vol. 5 October, 1911 No. 2

Who is to Pay? The worst year of fire waste since that of the San Francisco earthquake fire! That is the promise for 1911. How long will capital stay in the business of underwriting? Will it remain to carry the risk until the rapidly growing agencies of fire prevention make good their efforts in a curtailment of the frightful burnings? The Boston newspapers, following the issuance of the admirable report of the Chamber of Commerce, and the attack on the same by the speculators in shoddy building construction, quoted skeptically the Secretary of the National Fire Protection Association as saying that if Boston should have a fire like that of Baltimore or San Francisco, she need not expect to be rebuilt to the extent that those cities were rebuilt by insurance capital. But need such a statement necessarily be wide of the mark? It is time for these cities with undermanned fire departments, obsolete apparatus, and growing wooden districts, to take stock of their recuperative chances in the event of a conflagration; for should such a calamity occur somebody has got to pay.

The statistics of net results of fire underwriting for the years 1901 to 1910, inclusive, according to our active member the National Board of Fire Underwriters' reports, show losses paid of $1,301,218,715, and premiums received, fire, marine and inland, reported to the state of New York of $2,297,952,087, or a loss to balance the account, considering the increased liability and actual expenses paid on underwriting, of 1.01 per cent. It has been estimated that over a period of fifty years the underwriting profit will not exceed 3 per cent.

Statistics compiled of the increased capital investment in the business of fire underwriting as compared between the years 1870 and 1907, show capital invested in the year 1870 as compared with the capital stock of fire insurance companies in the year 1908 an increase of but $5,501,166 and a decrease of ninety-eight in the number of companies transacting business.

On January 1, 1906, the ratio of loss paying power to the amount at risk was 66 cents per $100. On January 1, 1910, the ratio was only 58 cents per $100, showing that the strength of the companies, taken as a

whole, to meet the burden assumed by them is less than it was before the year of the San Francisco conflagration.

In this connection it might be well to consider that while it has become customary to speak of fire insurance as a tax, that the insurance companies stand back of the tax and are obliged to make good any deficit. In the San Francisco disaster alone they contributed upwards of $70,000,000 in new capital, an amount almost equivalent to the present capital stock of all companies doing business in this country, in order to make good its contracts in that conflagration involving losses approximating $150,000,000.

The above data clearly demonstrates that the business would be far more profitable at a less average rate to the insurance companies provided the high potentiality of loss in the insurable properties were greatly reduced.

There is no answer to the problem except fire prevention. We must stop our burning to escape bankruptcy.

* * * * *

Motion-Picture Films. It isn't only shoddy builders whose personal financial interests are arrayed against the public welfare. We have all been so long bred to the consideration of the dollar that it is rare indeed for any concern in commercial life to be found in the van of progress where such pioneering brings neither an immediate nor remote prize in money. We are advised, upon reasonably reliable authority, that the much praised act of the Diamond Match Company in granting to all match manufacturers the right to make the sesquisulphide match has brought no result; that the manufacture of the "phossy jaw" match is continued because it is cheaper. If true, this is a pitiful manifestation of the light way in which the dollar disregards human life.

But in view of the holocausts that are still occurring in motion-picture houses the abandonment of the non-inflammable motion-picture film because it costs more than the fire-and-death film is perhaps the most disconcerting fact recently established.

The principal manufacturers of these goods are supplying the acetate of cellulose film only when required by their customers. Our hope, so frequently expressed, that the nitro-cellulose film, with its death-dealing qualities, would finally be absolutely supplanted by the non-inflammable film, is doomed to disappointment. The manufacturers of the non-inflammable film would be obliged to charge a higher price for the same than for the nitro-cellulose film, by reason of the greater cost of manufacture. A considerable number of manufacturers making motion pictures would not use the non-inflammable film even after it had been on the market for a year and a half. Therefore, their competitors, the manufacturers who used it from the beginning, were handicapped by reason of the higher cost of their raw material. The latter were not able to market the non-inflammable reels at any higher price than the inflammable reels, so that under these circumstances they ceased to submit to the handicap and returned to the inflammable film. The impression was given out that the non-inflam-

mable stock was much inferior to the cellulose nitrate stock in point of wearing quality, and that this was the controlling reason for dropping the use of the non-inflammable film. We have direct advices, however, from our member, the Eastman Kodak Company, that during the two years in which they have been making the non-inflammable film, constant improvements in the product have been made, and that for many months prior to the time when their customers gave up its use, the wearing quality was practically equal to that of the old stock, and that the complaints that the new film was deficient in this respect had ceased.

It is another clear case of consideration for the dollar outweighing the consideration for the life and safety of the people who patronize the motion-picture shows. Our only hope seems to be in perfecting and safeguarding the motion-picture booth, so that the fires caused by the inflammable film may be confined to the booth. It is obvious that the possibilities for panic are to be indefinitely continued.

* * * * *

The Cannonsburg Holocaust. That the bad record of the inflammable film has instilled a latent fear in the hearts of all motion-picture audiences, which fear may instantly break into disastrous panic, was exemplified by the death roll of the Cannonsburg, Pa., Opera House. Twenty-six dead from suffocation, 25 seriously injured, 30 suffering from minor hurts—that is the human toll exacted in that theatre on August 27th.

The picture machine developed a slight defect. There occurred a noise like "click." A boy shouted "Fire" and started for the narrow exit. Bolus Dubrowsky, a giant miner, jumped from his seat and ran wildly for the same exit. In a moment there was a fighting, struggling mass after him.

At the head of a narrow stairway leading to the street he tripped. As he rolled downstairs he swept others from their feet who were awaiting their turn to enter the theatre, and soon there was a pile of people at the foot of the stairs, battling like mad.

It was all over within a short time. Volunteer firemen, several policemen and a few level-headed citizens untangled the human mass. The unhurt and those slightly injured were pulled from the top of the pile. As they gained the street, they ran screaming like maniacs to all parts of the small town. One after another the suffocated victims, many of them women and small children, were carried to the sidewalk.

Bodies clogged the doorway. Men walked over them, fought their way, broke the glass transom over the door, crawled through and dropped to the street.

Manager Ferguson started for the stairs when the first alarm was given, but seeing there was no escape there, made his way to the stage. Calling loudly to the frightened people to follow him, he led the way to the rear of the stage. Fully 300 escaped that way.

In ten minutes the opera house was empty, and in half an hour twenty bodies had been recovered.

Of the dead, thirteen were children, seven of them pupils in the public schools. It was decided to postpone for a week the opening of the schools.

Arthur McPeake was passing the building when the bodies began to pile up at the door. He was dragging a body from the pile when a man came hurtling down the stairs and broke McPeake's neck.

Sydney Rittiger and his fiancee, Miss Lulu Fisher, were killed.

Wilmer Lane, a member of one of the volunteer fire companies, was working at the pile of bodies at the entrance when he came upon the lifeless forms of his two children beside his unconscious wife.

Samuel Lane was rushing down stairs when he saw a child almost under his feet. As he stooped to pick her up he recognized his own granddaughter. He was caught in the whirl and she was swept out of his reach and killed. He was seriously hurt.

This makes dreadful reading, for there was actually no danger of fire at any time. Our special report indicates that there was no fire whatever in the booth, nor any fuses blown. The moving picture apparatus was contained in a booth built in strict accordance with the specifications required under the Act of the Legislature of Pennsylvania, and we are satisfied, even though there had been a fire, the same would have been confined strictly to the booth. The panic seems to have been caused by a boy in the rear of the audience crying "Fire" when a film parted allowing the full illumination from the arc to be projected against the screen.

So long as the inflammable film is used, fires will be reported as caused by it in non-standard booths in states whose laws on the matter are still lax. These reports will for a long time suffice to keep fear alive in the breasts of the picture-loving public. One would think that the theatres themselves would exclude the nitro-cellulose film; but it may be we shall have to turn to the law to check this kind of commercial murder also. The cannon firecracker and toy pistol, with their tetanus poisoning, didn't die so very hard when we once actually went after them.

* * * * *

Going after New York Fire Traps. The right of the fire commissioner of New York to force factory owners to equip plants with automatic sprinklers having been established by Supreme Court decisions in the Christman and Winter cases, Fire Commissioner Johnson has decided to order them installed wherever he finds conditions that warrant them. Two hundred or more buildings will be ordered so equipped in the near future, it is said. An inspection of loft buildings and manufacturing quarters was one of the first official acts of Chief Kenlon, after which he sent a letter to the fire commissioner in which he said: "In order to minimize as far as possible the danger to life in loft buildings, especially those loft buildings used for the manufacturing of

cotton fabrics and such light clothing, I would respectfully recommend that you require the owners of all such buildings to equip them with automatic sprinklers." Commissioner Johnson upheld Chief Kenlon in his recommendation, and said the plan should be followed. He said: "While it is not the desire to bring about a condition where any industries might be driven from the city, the fact remains that certain buildings exist in which a far better protection for employes is not only urgent, but necessary. It is in these buildings that the fire department will endeavor to lessen the danger to human life immediately. Conditions such as existed in the building in Washington place, where all those lives were lost, do not exist in every building of that general type in the city, but in some of them grave conditions do exist, as the inspection by Chief Kenlon shows. It is against the latter that the activities of the fire department will be directed. I do not want to be understood as entering upon any wholesale or indiscriminate crusade. There may be lofts of the exact character of the Washington place building loft where there is very little fire hazard on account of the character of the work being done: the materials used in this work may not be inflammable, and we might not regard a condition under those circumstances as dangerous. But wherever light, flimsy and highly inflammable materials are being worked, especially fabrics, we shall have to exercise the closest scrutiny to see that every safeguard is placed around the workers." Chief Kenlon said: "At least 60 per cent of the loft buildings in lower Manhattan are protected in this manner. Of the loft buildings which have been inspected, the unprotected 40 per cent are without doubt the greatest menace to human life by fire now existing in New York. These buildings are more than 200 in number, and are used in many cases as sweatshops. Most of them are south of Twenty-third Street and west of Fourth Avenue."

* * * * *

New York and London Fires. The New York City Board of Estimate will be asked to appropriate twelve million dollars for the maintenance of the fire department during the next fiscal year. This is about four million dollars in excess of the sum expended for the same purpose during the current year. In making the request, Commissioner Johnson says that the increase will be used in extending the department. He argues that New York's needs have grown more nearly in geometrical than in arithmetical progression. The increase in actual area of fire-protected districts, the difficulties attending the safeguarding of localities where many old buildings remain to menace the new ones, and the great height of some of the modern structures are but a few of the obvious features in Commissioner Johnson's opinion of the present situation. New York covers an area of 209,218 acres and has a population of 22.7 per acre. Last year there were 14,405 fires, with losses aggregating $8,591,831. There are 4,332 uniformed members in the fire department and 804 pieces of apparatus. London, with an area of 441,600 acres, has a population of 16.4 per acre. Last year there were 3,208 fires in London, the total loss

being $2,930,115. There are 1,365 uniformed firemen in the London department and the cost of maintenance last year was $1,363,900. It should be understood that the London figures are given for the metropolitan district, which extends for about fifteen miles in every direction from the city's center. Commissioner Johnson draws a comparison between New York and London in these words: "We are now having about fourteen thousand fires a year, as against less than four thousand in London proper or in that part of central London having about the same population as Greater New York. While it is true that from a fire hazard standpoint construction in London is far safer than in New York, on account of the materials used and greater conservation in building, still it seems a remediable situation that New York should have more than three times the number of incipient blazes of London. Our fire marshals' investigation reveals that the loss in more than 30 per cent of all fires is less than $10. This indicates a wide field for the bureau of fire prevention." A formidable portion of the extra four million dollars asked for by the commissioner will be expended for motorizing the department and providing better protection for the outlying districts, especially on Staten Island. High pressure will also be introduced in all districts of greatest hazard, and scientific inspection will be made of all buildings with a view to introducing fire prevention.

* * * * *

Fireproof Buildings in New York. Our associate member Mr. Rudolph P. Miller, Superintendent of Buildings of New York City, devotes a considerable part of his report for 1910 to the subject of fireproof construction. There seems to be an impression, says Mr. Miller, that a majority of the buildings annually erected under the building code are of ordinary, that is, non-fireproof construction. The analysis of the permits issued during 1910 does not justify this belief. Of 805 new buildings to be erected 250, or 31 per cent, were to be of fireproof construction. This alone, he adds, would not disprove the former assertion. Fireproof buildings, however, nearly always cover a larger ground area than those of a cheaper grade and go to greater heights, and thus to arrive at a fair comparison of the extent of fireproof construction in Manhattan, Mr. Miller has taken as a basis the ground area covered. Working on this principle, it was found that of the ground area to be covered by new buildings for which permits were issued in 1910, 49 per cent was to be covered with fireproof structures.

By comparing the entire floor area 68 per cent of the total is found to be of fireproof construction, while the estimated cost of such buildings is 77 per cent of the total.

* * * * *

Pittsburg Fire Dangers. It must have been a shock to those persons in Pittsburg who, while ignoring the fire hazards of that city and clamoring for reduced insurance rates, appealed to Mr. Herbert M. Wilson for a word on the situation and were told by him that Pitts-

burg deserved no lower rates. Mr. Wilson, who is one of our associate members and chairman of our committee on Mine Fires, is engineer in charge of the United States Geological Survey, and is now in charge of the Bureau of Mines at Pittsburg. He has devoted a great deal of attention to the subject of the fire waste of the country. He was in charge of the investigation made by the Geological Survey for the National Conservation Commission, which prepared a great mass of official statistics as to fire waste and the cost of fire fighting.

Mr. Wilson when applied to for a statement by the interests in Pittsburg which are investigating fire insurance rates in that city, after investigation, issued a prepared statement in which he held, in general, that conditions in Pittsburg did not justify a general reduction in rates, and that its conflagration hazards were exceedingly serious. Mr. Wilson held that frequently a community or its official representatives were to blame for conditions which it charges upon others. He said that he knew from his experience that the insurance companies are seeking in every way to prevent fires and preferred a lower average rate with bettered conditions. A community is at fault when it permits the continued existence, adjacent to fire-resisting structures in congested centers, of such inflammable fire breeders as the frame structures huddled in countless numbers in the more densely built portions of Pittsburg.

He knew from his study of these problems for the United States Government that too often insurance companies are expected to reduce rates, or to give as favorable rates as may be given in other cities, when the physical conditions do not warrant such action. He held that Pittsburg was fortunate in that it has not in many years been visited by a serious fire, yet it is more vulnerable than San Francisco, Baltimore or Chicago were when each of these cities was nearly destroyed by fire. It would seem that the American people had become so calloused by the daily reports of fire that their attitude on the subject has become wholly perverted. Mr. Wilson cited the very much lower fire losses in foreign countries, where the building laws are better and personal responsibility is enforced, and closed as follows: "If Pittsburg wants prosperity and to encourage the growth of diversified industries within its borders, there is hardly any measure which the committee could adopt which would give greater encouragement to the investor or prospective manufacturer than to reduce the fire risks within its borders and thereby reduce insurance rates and accompanying fire taxes of all kinds."

* * * * *

Conditions in Chicago. A report issued by the United States Geological Survey shows that Chicago is very lax in requiring new buildings to be constructed of fireproof materials. The report discloses that the construction of wooden buildings in Chicago in 1909 was more extensive than in any other city in the country. In most large cities the regulations allow but few buildings of wood to be constructed nowadays. In fireproof buildings Chicago was second to New York. The latter leads in the number of

new brick structures, but Chicago stands first in stone and concrete. "Chicago," says the bulletin, "was the leading city in the cost of wooden buildings, reporting a total of $13,538,880. San Francisco was second with a total of $12,257,683. Reading was the only city that reported no wooden buildings erected. New York reported 823 permits for buildings of wood, costing $3,697,555, an average cost of $4,492. These were almost entirely in the Borough of the Bronx.

"In Philadelphia only twenty-four new wooden buildings were erected, at a total cost of $38,000. New York reported the construction of fire-resisting buildings at a cost of $181,918,337, or 27.78 per cent of the total for this class of structures. Chicago was second with a cost of $79,105,500, or 12.08 per cent of the total. New York was the leading city in new brick buildings and reported a cost of $151,832,438, or an average of $60,395 a building; Brooklyn was second with $51,747,760, an average of $6,564; Chicago was third with $51,145,400, an average cost of $8,581, and Philadelphia fourth with $30,653,580, an average cost of $2,956.

"In stone buildings Chicago was the leading city and reported 83.69 per cent of all erected and 57.08 of the cost of these buildings, with an average cost of $7,965. New York was second with an average cost of $111,677. San Francisco was third with an average cost of $149,086. The leading city in the number and cost of concrete buildings was Chicago, which reported 519 buildings, costing $9,894,800, or 32.31 per cent of the cost of all concrete buildings. The city ranking second in cost of concrete buildings was Seattle, which reported $2,872,400, or 9.38 per cent of the total, followed closely by Philadelphia with $2,014,300, or 6.58 per cent of the total."

* * * * *

Forest Fires in Massachusetts. The commendable and persistent efforts of our active member the Massachusetts Mutual Fire Insurance Union to stop the forest fires in the state set by campers and boys with bonfires, has been rewarded by the passage of the following law by the Massachusetts legislature:—

It shall be unlawful within any city, or within any town which *accepts the provisions of this act*, for any person to set a fire in the open air between the first day of March and the first day of December, except by the written consent of the forest warden or chief of the fire department, or, in cities that have such an official, the fire commissioner; provided, that debris from fields, gardens and orchards, or leaves and rubbish from yards may be burned on plowed fields, by the owners thereof, their agents or lessees; and provided, further, that persons above 18 years of age may maintain a fire for a reasonable purpose upon sandy or barren land; if the fire is included within rocks, metal or non-inflammable material. In every case such fire shall be at least 200 feet distant from any forest or sprout lands, and at least 50 feet distant from any dwelling, and shall be properly attended until it is extinguished. The forest warden shall cause public notices to be given of the provisions of this section, and shall enforce the same. Whoever violates the provisions of this section shall be punished by a fine of not more than $100, or by imprisonment for not more than one month, or both such fine and imprisonment.

No one not familiar with the statistics has any idea of the way in which Massachusetts has been ravaged by forest fires. There is plenty of rain this fall, but the previous four or five years have been exceedingly dry. One thirty-ninth of the forest area of the state was destroyed by fire during the first six months of the present year.

Returns for the half year ending June 30 show 100 square miles of forest area of this state was burned over, a record, comparatively speaking, 250 times worse than that of our national forests.

A liberal estimate of the state's forest area, which would include much scrub growth and rather thinly stocked pasture, is 2,500,000 acres, of which the records show one in thirty-nine has been burned. In the national forests it is one acre in 10,000 that is annually destroyed, and in Germany one acre in 15,000.

How Massachusetts shows up, compared to some of the other states, this table shows:—

	Area of State (acres.)	Acres burned.	Loss.
MASSACHUSETTS.			
1911	5,400,000	64,273	$535,865
NEW HAMPSHIRE.			
1910	5,955,200	11,000	55,500
MAINE.			
1910	21,145,000	948	2,841
MINNESOTA.			
1909	53,353,600	45,690	61,170

Although the direct loss was $535,865, the total loss, which includes the destruction of about 100 buildings, brings the final figure up to $1,000,000. In the comparison the loss of Massachusetts is given for only six months and in the case of the other states for an entire year.

* * * * *

Death of Mr. C. A. Hague In the death of Charles A. Hague, for many years a member of our Executive Committee, and representative of the American Waterworks Association, the National Fire Protection Association has lost one of its most valued members. Mr. Hague for years had been widely known as a civil engineer of exceptional skill and was always of great value in our councils. He was for a long time connected with the pumping engine department of Henry R. Worthington, and upon the amalgamation of that company with the International Steam Pump Company, Mr. Hague had acted in the capacity of consulting and constructing engineer of several water systems, including those in Trenton, N. J., Harrisburg, Pa., and other cities, where his

work was passed upon as of the highest order. Being an active member of the American and the New England Waterworks Associations and of the American Society of Civil Engineers, he had formed a large acquaintance among men of his calling in whose esteem he was always held high. Two years ago Mr. Hague was chairman of the American Waterworks Association committee on specifications for cast-iron pipe, and it was through his untiring efforts that the recommendations of this committee were adopted by the Association. Of commanding personality, sterling character and affable manner, Charles A. Hague drew men to him in such a way as to make them lasting friends, hence the widespread sorrow at his death while yet in the best years of his manhood. He was a prolific writer on subjects allied with his profession, and possessed unusual descriptive ability in detailing construction operations and pointing out scientific features in connection with large engineering propositions, especially those relating to pumping machinery. We will miss greatly Mr. Hague's genial presence and valuable counsel at our annual meetings.

Public Education

In looking over the periodicals of the past year one is amazed at the growing recognition of the economic effects of the fire waste. Three years ago the discussion of this subject in the press was practically unknown. Certain vague editorial comment would sometimes follow a disastrous fire, but seldom would such articles go into the general significance of the fire waste. Now, however, there exists hardly a periodical which professes interest in the welfare of the people but is having something to say on the subject of the national ash heap. We suppose it is too much to assume that the present wide discussion of the subject is due wholly to the publicity work of our Association, and yet it is obvious that an organization like ours, with its great scope and influence, can get a very positive movement under way in a comparatively short time; and it will be noted that all this discussion in the press has been undertaken since the beginning of the active publicity work of this Association three years ago. We now have a large press list to which all our publications are sent. We are constantly in receipt of evidence that these publications are carefully read and voluminously quoted; which means that the majority of our correspondents constitute individual centers from which information gathered by us goes out in widening circles.

The great amount of education accomplished by our Speakers' Bureau, which has drawn into its service men of wide ability and education, has also had a telling effect upon the country. The immense and growing burden of our office correspondence indicates that our Association is looked to as the repository of authoritative facts and which in itself is proof that

the present consideration given these subjects is at least largely the result of our initiative. The demands already made upon the Association to furnish speakers for the coming winter is at present out of all proportion to our abilities to meet. It is necessary for the Secretary, especially, to pick and choose those engagements which would seem to give the widest opportunities for public education. Three prominent universities have already applied for lectures on the fire waste.

The most gratifying fact in connection with the speaker's work is that our membership is of such a character as to enable us to secure devoted and intelligent service of this kind from almost any part of the country. The admirable work and co-operation of our active member the National Association of Credit Men makes it possible for us to reach every large city of the country in the best possible manner for securing wide publicity for our efforts. The tour of Secretary Wentworth last season, under the auspices of the Credit Men, through all the states east of the Mississippi is to be supplemented during the coming season by a similar speaking tour covering the states between the Mississippi and the Pacific Ocean. As in the former case, Secretary Wentworth is to be accompanied on this extensive tour by Mr. Charles E. Meek, who is now Vice President of the National Association of Credit Men and Assistant Cashier of the Fourth National Bank, New York City.

* * * * *

Another indication of the growing recognition of the importance of our cause is the attention that is coming to be given to it by conferences and conventions throughout the nation. In September two such conferences set aside definite periods for consideration of the fire waste. One of them was the International Municipal Congress and Exposition, held in Chicago, which devoted an evening to a public meeting, with one of our associate members, Mr. E. B. Case, as chairman, and other members, Mr. H. H. Glidden and H. N. Kelsey, as speakers.

The National Conservation Congress, held at Kansas City, also gave consideration to the subject, receiving a very important and well conceived address from a committee of our active member the National Board of Fire Underwriters, composed of Messrs. George W. Babb, Charles S. Kremer, E. W. West, E. G. Richards, R. M. Bissell, R. Dale Benson and C. G. Smith. The address was presented by General Agent W. E. Mallalieu. We were directly represented at the Congress by specially appointed delegates, who presented a memorial in behalf of our Association and its objects. The delegates were Mr. Chas. E. Eldridge of Topeka, chairman, Mr. J. B. Bush, Mr. F. J. Fetter and Mr. F. M. Pond.

The thirty-ninth annual convention of our active member the International Association of Fire Engineers, held last month in Milwaukee, also, of course, gave due consideration to the subject of the prevention of fires. Members of our Association like H. C. Henley and W. C. Robinson were on the program, the former for the purpose of urging the creation of the

office of State Fire Marshal in all the states, and the latter, who is chairman of our committee on Fire Hose, for the purpose of securing the cooperation of the fire chiefs in the best method of selecting hose for fire department purposes.

* * * * *

The rapidly extending agitation for a Fire Prevention Day, which is largely the result of the activity of the Committee on Publicity and Education of our active member the Western Union, is also an influence calculated to focus the attention of the people on the object of our endeavor. A number of the states, following proclamations by the governor, immediately arranged such a special day. Among the organizations taking such initiative was the Indianapolis Trade Association, which arranged a big mass meeting at Indianapolis for Monday evening, October 9th, the anniversary of the great Chicago conflagration of 1871. Secretary Wentworth made a special trip to Indianapolis to speak at this meeting, following the same with a lecture on the fire waste at Purdue University at Lafayette, Indiana. It is evident that as this form of observance is extended our Association will be hard pressed to furnish speakers for such occasions. Secretary Wentworth has agreed to speak at the Fire Prevention Congress to be held at St. Paul early in November. This is a state function, to which invitations have been issued by the governor. Along with this Fire Prevention Day agitation generally goes the recommendation that the public schools take up the subject in lessons and lectures. This also is an instrumentality through which valuable educational results may be obtained.

* * * * *

The Chamber of Commerce of Rochester, New York, after the preparation and issuance during the year of two excellent brochures on the fire waste (beside keeping up a constant agitation in the local press) gave special public recognition to the work of its committee having this important subject in charge by holding an elaborate banquet on the evening of October 16th. The speakers on this occasion were our associate member Edward F. Croker, former chief of the New York fire department, and Secretary Wentworth of the National Fire Protection Association. Exchief Croker has been giving splendid service to the cause of fire prevention since he has been free from his official duties in New York. He has not only been making important speeches but has contributed several excellent articles during the past few months to the magazines.

* * * * *

Mr. F. E. Cabot of Boston, chairman of our Electrical Committee, which is charged with the responsibility of maintaining and amending the National Electrical Code, made a special trip to Niagara Falls to speak at the eleventh annual convention of our active member the National Electrical Contractors' Association.

He said, among other things, that the loss by fire in this country last year was between two hundred and two hundred and fifty millions of dollars, and that the loss by fire caused by electricity was but fifty thousand.

Mr. Cabot also said that as regards the progress of electrical protection and the work on the Rules, his association did not owe as much to any outside source as to the National Electrical Contractors' Association.

He cautioned all within hearing of his voice to think if there was not some place near his respective home or business where a fire might happen, and to take steps to check trouble. "Have the subject of fire loss in your mind at least once a week. It will pay. Every man should help overcome this loss of wealth. There are more hazards to-day than 28 years ago, although conditions to prevent fire have improved over 400 per cent. The electricity in this country represents a potential that, if it were loose, would burn up five hundred millions of dollars. Control it." These are a few of Mr. Cabot's significant expressions.

* * * * *

Mr. Powell Evans, one of our Philadelphia members, and to whom we are indebted for first inducing the National Association of Credit Men to become an active member, has given much time and energy during the year to fire prevention legislation in the city of Philadelphia and the state of Pennsylvania through pamphlets of which he has been the author; through speeches which have been given wide publicity in the press; and through special articles in such publications as the *Survey* and others. He has exhibited a devotion to our cause which has not failed of its salutary effect. On one occasion Mr. Evans, in the interest of the state and city fire marshal bills, wrote personal letters to one hundred and fifty managing editors of the newspapers in the state of Pennsylvania. He has arranged frequent conferences on fire prevention at the clubs and other organizations of Philadelphia. Besides his public activities, Mr. Evans is constantly at work advancing the cause of fire prevention in direct personal ways, such as the printing and promulgation to the architects and engineers of the country of 10,000 copies of bills on fire prevention legislation. These proposed enactments were bound in a special cover, upon which were printed special messages from Mr. Evans himself and quotations of striking editorials on the fire waste taken from Philadelphia newspapers which Mr. Evans had previously induced to investigate the subject. Mr. Evans' activity has extended beyond his state, as is evidenced by special articles on the subject of fire marshal laws written for papers of the middle West, such as the *Chicago Evening Post*.

* * * * *

Another devoted worker who spends all the time he can spare from scientific fruit cultivation in the state of Oregon is Frederick H. Cowles. He has been diligently at work since moving to Oregon in making the little city of Medford, where he resides, the center of an active agitation for better building and proper observance of fire precautions.

* * * * *

Something new in the way of juvenile literature made its appearance from the publishing house of Little, Brown & Co., Boston, in September when a book called "Firebrands" was published. Written by our asso-

ciate member Frank E. Martin, Secretary of the New Hampshire Fire Insurance Company, and Dr. George M. Davis, both of Manchester, N. H., "Firebrands" is designed to teach children how to avoid setting a fire, how to extinguish one, and how to hold one in check until the arrival of help. Each story in the book tells how a fire is started, how it should have been avoided, and how it was put out. The fire stories are made really interesting to children. They are full of vivacity and animation, and none of them are over the heads of young readers. When Mr. Brown Rat builds his nest with matches which were left around the house, the story of what happened is not a dull one. When careless Joe throws hot ashes into a wooden box, the sequel is also exciting. When boys light a bonfire and leave the hot embers, the other boys are interested in reading how old North Wind comes along and has a bonfire himself. The book, as a whole, is a good example of the fact that the best instruction is accomplished by indirection.

* * * * *

One of the notable features of the campaign against the fire waste is the growing popularity of instruction of the children in the public schools in fire drills, the dangers of the fire waste and the best manner of preventing and extinguishing fires. Three states have enacted laws this year requiring instruction on this subject in the schools, and a large number of cities have taken action without waiting for statutory authority. An instance of the benefits of such instruction is reported from school district No. 9 at Stanwood, Wash., where fire drills and instruction are required by law. A fire originated during school hours from a furnace pipe coming in contact with wood. When the fire occurred the children immediately formed into line, using their lunch pails and other buckets, and with the aid of water from the well and a small stream nearby they extinguished the fire and saved the property, even removing all furniture and fixtures without any breakage. The fire had gained such headway as to burn a space five feet square from the basement to the roof, including an area on the roof at least 15 by 25 feet. The adjusters who settled the loss reported that the fire was handled and extinguished better than the average fire department would have done, and that the work of the children undoubtedly prevented a total loss.

* * * * *

An entirely new departure, so far as we know, occurs in the small Massachusetts city of Canton, where the Men's Club of the Baptist Church has regularly appointed a fire prevention committee, whose duty is to keep the electric wiring of the church (and the additions thereto which are frequently made at Christmas time) under inspection. This committee has also to look after the heating devices, flues, etc., to make sure they are left in proper condition when the fires go out in the spring and that all conditions are right before again starting fires in the fall. If all churches were to do likewise they would have a better fire record.

The sixth annual meeting of the League of Virginia Municipalities gave consideration to the fire waste at its meeting in September at Cape Charles, Virginia, where Secretary Wentworth had the opportunity to place the work and accomplishments of our Association before the assembled Mayors of Virginia. Secretary Wentworth's speech was stenographically reported and he was assured by the chairman of the meeting that the same would be extensively copied and commented upon throughout the state. There is no doubt that the educational opportunity given was a very real one. The convention was small in number but of the quality of influential men very unusual.

Secretary Wentworth also spoke at the annual convention of the National Association of Mutual Fire Insurance Companies at Philadelphia in September. His October dates, besides the Fire Prevention Day at Indianapolis on the 9th, Purdue University on the 10th and the Rochester, New York, banquet on the 16th, were a dinner of the New England Dry Goods Association at the Boston City Club October 24th, a dinner of the Credit Men at Utica, New York, October 25th, and the Fire Prevention Meeting arranged at Louisville, Kentucky, by our active member the Kentucky State Fire Prevention Association on October 27th.

* * * * *

The Committee on fire prevention of the Boston Chamber of Commerce, after giving much careful consideration to the subject extending over a period of more than a year, has finally issued its report, the recommendations contained in which are as follows: —

Recommendations.

1.

To reduce the construction hazard: —

(*a*) The enactment of city ordinances which shall prohibit the construction of any third class building within the city limits.

(*b*) The enactment of a law prohibiting the construction of any but fireproof buildings within the congested business district of the city.

(*c*) The passage of a law requiring all second or third class buildings now existing within the congested business district of the city to be equipped with sprinkler service, except that houses for habitation not used in any portion for any other purpose need not be so equipped, and that hotels and lodging houses need be so equipped only in the basement, first story and public halls, dining rooms or assembly rooms.

2.

To prevent carelessness or deliberate mismanagement: —

(*a*) The passage of a law creating a Fire Bureau empowered to examine into every fire and make a published report thereon, giving in detail the cause of the fire and locating the exact responsibility in much the same manner as a coroner's jury investigates a crime.

(*b*) The passage of a law regulating the issuing of insurance policies covering any building previous to approval by formal act of said Fire Bureau.

3.

To improve the efficiency of the fire-fighting systems: —

(*a*) A high pressure fire service carried through the streets of the congested portion of the city.

(*b*) Doing away, as rapidly as conditions will permit, with the obsolete and cumbersome system of portable engines and machinery operated by horses, and the substitution of self-propelled fire apparatus.

Conflagrations Involving Losses of $500,000 and Over Occurring in 1910.

February	4	New York City	N. Y. Med. Supply, U. S. A. Dept.	$500,000
	22	Pueblo, Colo.	Minnequa Plant of Colo. Fuel and Iron Co., Pattern Storehouses	600,000
March	5	Winlock, Wash.	Business Portion of Town	650,000
	24	Hambleton, W. Va.	Tannery	800,000
	26	Philadelphia, Pa.	Oil Warehouse, Mantel Factory and Lumber Yard and Mill	600,000
April	3	Omaha, Neb.	Central Gr. Elev. of Nye-Schneider Fowler Co., Manly Milling Co. and Box Cars	600,000
	9	Beaver Falls, Pa.	Union Drawn Steel Acme Mfg. Co. Plants and Acme Typewriter Mfg. Co.	500,000
	27	St. Louis, Mo.	Brewery Plant of Anheuser-Busch Brewing Assn.	530,000
May	2	Ford City, Pa.	Pittsburgh Plate Glass	
	4	Kansas City, Kan.	Peet Bros. Mfg. Co. Soap and Glycerine Plant	1,500,000
	22	Elkhart, Ind.	C. G. Conn. Band Instrument Fcty.	500,000
	25	Bluff Point, N. Y.	Hotel Champlain	500,000
	28	Minneapolis, Minn.	Implement Warehouses	750,000
June	27	Paterson, N. J.	Van Dyke Furniture Store and others	502,000
July		Marinette, Wis.	Timber Lands and Saw Mills	1,200,000
	16	New York City	S. S. Pier and Freight (Met. S. S. Co.)	750,000
		Lakeview, Ill.	Grain Elev. and Brewery	600,000
	18	Wallace, Idaho.	Half the town	1,000,000
August	9	Boston, Mass.	Blacker & Shepard Lumber Yds. and others	600,000
	17	Jersey City, N. J.	Truslow & Fulle Cork Wks. and others	700,000
	24	Stevenson, Wash.	Saw Mill and Standing Timber	600,000
October	18	James City, Pa.	American Plate Glass Works	500,000
	20	E. St. Louis, Ill.	Chicago & Alton R. R. Freight House and others	500,000
	25	Superior, Wis.	Coal Shed and Wharf	500,000
	29	Topeka, Kan.	Storage Yards of Atchison, Topeka & Kansas R. R.	500,000
	30	Omaha, Neb.	Creamery and Cold Storage (Plant of Fairmount Creamery Co.)	600,000
November	3	Philadelphia, Pa.	Cunningham Supply Co. Bldg., Block and Storage Warehouse.	500,000
	27	Livingstone, Ala.	Sumter Lumber Plant	500,000
December	6	Evansville, Ind.	H. Feurich, Cig. Fcty. and others	750,000
	21	Cincinnati, O.	Kippendorf & O'Neil, Shoe Fcty. and Leather Works	1,750,000
	22	Chicago, Ill,	Morris & Co., Meat Pckg. Plants.	1,000,000
				$22,582,000
		Conflagrations prior to 1910 (since 1866)		$983,234,135
		Total for period		$1,005,816,135

The Salvage Corps.

Its Functions and its Status.

A protective agency that had its birth long before that of any organized effort at fire prevention or protection is the salvage corps, or "fire patrol," which has been maintained for many years in certain cities of the country either by the cities themselves, frequently as an auxiliary of the fire department, or by the fire insurance companies or agencies at their own cost.

An examination of the varying status of these salvage corps serves as a most interesting barometer of the state of the local municipal consciousness regarding the common responsibility for the fire waste. For it must be remembered that these corps do not pick and choose whose property they shall attempt to save. They inquire not and know not what stocks of goods are insured. Though they may be supported by insurance companies, their service must be, and is, perforce, as impersonal as the service of the sun, which warms with equal diligence the back of the perfumed lady and the little beggar child; or as the rain which freshens alike the field of the just man and the unjust. The service of the salvage corps is a common municipal service, however its maintenance may be evaded by the municipality which profits by it.

Every merchant conceives that the chances of a fire in his premises are too remote to warrant the expense of maintaining a private equipment of men and oiled "covers" to spread over his stocks to protect them from excessive damage by water. The great millionaire merchants may do this, but not the large number of ordinary vendors of merchandise. The care and storage of the covers, and the drills and training of the men are too expensive.

The function of the salvage corps is therefore not profitably an individual function, but a collective function, operating for the benefit of every or any citizen having goods to be saved, be the same vendable merchandise or the furniture and pictures in his home. This being so, its maintenance by insurance companies is anomalous and an evasion of municipal responsibility.

It is obvious that the chief requirement of the salvage corps is speed in arriving at fires and quickness in spreading the covers, for unless they get in their work before the fire department begins to throw water they are too late for their designed function.

It is a striking indication of how slow the American people have been in recognizing their collective responsibility for the fire waste that salvage corps are not maintained by every municipality. For the instinct to save property from fire is really deep-seated in every individual whenever his own is in question. Men will frequently risk their lives to save their property, and the less self-possessed of us frequently are thrown into panic by this instinct, as is indicated at its extremest by the story of him who frantically ran downstairs with a feather bed on his back after throwing the baby out of the window.

An inquiry into the status of the salvage corps in thirty-five American cities shows variation not at all attributable to territorial position. Cities like Chicago, Baltimore and San Francisco, which, if any at all, should have learned municipal responsibility, are still clinging to the skirts of the insurance companies not only for indemnity but for salvage care and protection, evidently with the *naive* notion still in their municipal heads that no one should be interested in the fire waste except those who are growing greenbacks in the moon with which to pay for it.

On the other hand we find cities, from Rochester, N. Y. (which is at present, through its Chamber of Commerce, making a notable fire prevention campaign) to Hackensack, N. J., looking after their own salvage organizations in a manner that to the ordinary unconscious firebug must seem almost human. One city, Providence, R. I. (with perhaps a vague consciousness that its name entails an obligation of protective function) shares the expense of maintaining the salvage corps with the insurance companies doing business in it.

The list of thirty-five cities, with their indicated status, is given below, and is believed to be accurate, although the data was secured from correspondents and not by personal investigation by the editor.

CITY.	HOW SALVAGE CORPS IS MAINTAINED.
Atlanta, Ga.	City: Fire department carries covers and does salvage work.
Bridgeport, Conn.	" "
Burlington, Vt.	" "
Dayton, Ohio.	" "
Hartford, Conn.	" "
Haverhill, Mass.	" Fire department has two protective wagons, equipped with chemical tanks. One carries twelve covers, the other eight. Eighteen covers in reserve.
Hackensack, N. J.	" Small corps.
Lawrence, Mass.	" Protective Company with two-horse wagon, carrying twelve covers, a sixty-gallon chemical tank and minor equipment of hose wagon.
Lowell, Mass.	" Protective Company with two-horse wagon, carrying twenty-five covers, chemical extinguishers and short ladders.
New Bedford, Mass.	" Fire department carries covers and does salvage work.
Omaha, Neb.	" "

CITY.	HOW SALVAGE CORPS IS MAINTAINED.
Providence, R. I.	Maintained jointly by city and insurance companies; city furnishes station, horses, feed and drivers. Insurance companies furnish apparatus and pay salaries of the men except drivers.
Rochester, N. Y.	City: Protective Company with wagon and sixteen covers.
San Antonio, Texas.	City: Fire department carries covers and does salvage work.
Schenectady, N. Y.	" "
Albany, N. Y.	Maintained by insurance companies.
Baltimore, Md.	"
Boston, Mass.	"
Chicago, Ill.	"
Cincinnati, O.	"
Duluth, Minn.	"
Kansas City, Mo.	"
Louisville, Ky.	"
Memphis, Tenn.	"
Milwaukee, Wis.	"
Minneapolis, Minn.	"
Mobile, Ala.	"
Newark, N. J.	"
New York, N. Y.	"
New Orleans, La.	"
Philadelphia, Pa.	"
San Francisco, Cal.	"
St. Louis, Mo.	"
St. Paul, Minn.	"
Worcester, Mass.	"

It will be noted that it is the largest cities, in which the created values are greatest, which leave the care of their goods to the fire insurance companies. One finds oneself wondering whether, in case the insurance companies could adopt the selfish policy of looking only after their own risks, certain faint commercial yelpings might not be heard in some of the back streets of the twenty last-named cities.

Is the Banker a Good Citizen?

When during the current year one of our executives, Mr. Charles E. Meek, laid down the secretaryship of our active member the National Association of Credit Men, and went to a New York bank as assistant cashier, he took all his zeal for fire prevention with him. As a preliminary test of his new affiliations he thought he'd find out how vitally the bankers of the country were concerned with the fire waste. It occurred to him that these men must be vitally interested in the fire protection conditions of their cities, as they loan money on bond and mortgage, and while it is true that mortgaged property as a rule is pretty well protected through insurance, any serious conflagration might prove disastrous to the lenders.

Then, too, he thought they might be interested in the welfare of their communities just as citizens. So he walked down William Street to the office of our active member the National Board of Fire Underwriters and picked out a special assortment of their carefully prepared reports of the fire conditions of American cities. He selected the cities most recently inspected, so that the reports would be up to date and properly impressive. Anyone who has seen these reports, with their carefully prepared colored maps and descriptions of the local water-works, fire department, hazards, etc., must have been impressed by the money and engineering skill put into them by the National Board, for which it cannot expect any direct return.

Mr. Meek carried these reports back to his bank, and sent one of them to the president of each prominent financial institution in every city reported upon, dictating the following letter on the letterhead of his own bank:—

. . . . . President,
. . . . . Bank,
. . . . . .

DEAR SIR:—

There is no more serious question confronting the people of this country at the present time than the tremendous waste taking place annually through loss by fire.

As former secretary of the National Association of Credit Men I became deeply interested in aiding the fire protection movement as best I could. I am still in a position where I can keep in touch with the situation and contribute something toward the movement before referred to. This for the reason that I am on the executive committee of the National Fire Protection Association. The Association is thrown closely in touch with the National Board of Fire Underwriters, among whose functions is the making of inspections through competent engineers and the printing of their findings.

Such an inspection has been recently made of fire conditions in your city, and believing that you will be interested in it, I am sending you under other cover a copy, and I respectfully suggest that you use your influence towards having put into effect such recommendations as the report contains.

Our annual fire loss is approximately $250,000,000. If we were to dump into the sea an equal amount of wheat or cotton, the effect would be quickly felt, and if we were to annually lose the same amount out of the National Treasury our country would soon be filing a voluntary petition in bankruptcy.

Very truly yours,
CHARLES E. MEEK,
Assistant Cashier.

Mr. Meek wrote this personal letter and sent the beautiful reports in their chaste white covers to the presidents of seventy-five banks in all, in the cities recently inspected.

How many banks out of the seventy-five thought the matter important enough to warrant an acknowledgment of Mr. Meek's letter? THREE!

Who knows the answer?

The Fire-Breeding Shack.

Any building or other structure, which, for want of proper repair, or by reason of age or dilapidated condition, or for any cause, is especially liable to fire, and which is so situated as to endanger other buildings or property; and any combustible or explosive material, or inflammable conditions, placed, kept, or existing in or upon any building or premises which is dangerous to the safety of said building or premises, and the same is so situated as to endanger other buildings or property, is hereby deemed and declared to be a nuisance; and any owner or occupant of such building or premises who shall cause, continue or maintain any such nuisance shall be guilty of a misdemeanor and, on conviction thereof, shall be fined in any sum not exceeding the sum of $500.00 and the court shall order said nuisance to be abated.

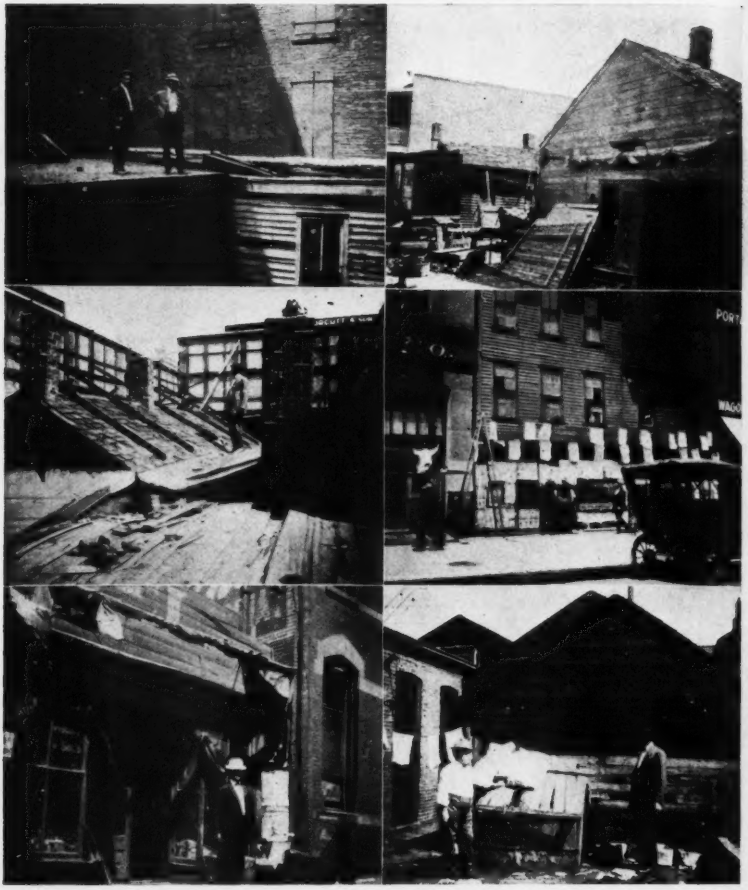
If any such owner or occupant shall fail to comply with said order, he shall be prosecuted for maintaining a nuisance, and said nuisance shall be abated.—*Nebraska State Laws.* 5985e. Sec. 5.

It must be a rude shock to the Fire Fiend, while browsing among the usually innocuous paragraphs of a state code of laws, to encounter the above in the Nebraska statutes; but when he is called upon to face the enforcement of such a law, not only in Nebraska but in an increasing number of states, it must bring him close to despair. For the fire-breeding shack has been the Fire Fiend's legitimate food since American civilization crystallized in cities. He has generally taken it as the first bite of the feast of a conflagration. To be denied this first bite means the denial of many a feast, for it is obvious that upon the conflagration menu the shack is often not only an item which must be taken to start the feast, but which must appear again between the courses to insure its continuance. Through the courtesy of our active member the Nebraska State Fire Prevention Association we present herewith a group of six photographs of shacks in the city of Omaha of which the state fire marshal has ordered the demolition. It will be noted that these condemned structures in every instance menace other desirable property. Marshal Randall furnishes the State Fire Prevention Association with lists of all defective properties, and is doing a very thorough work in his state.

As the result of the law enacted at the last session of the Ohio general assembly, whereby the scope of the fire marshal's activities was increased and that official was given power to compel the destruction of fire traps, hundreds of ramshackle buildings throughout Ohio will be demolished.

The law provides for hearings in case owners of buildings dissent from the orders of the fire marshal, but if the order stands after inspection and hearing, it is final. If the owner then refuses to raze the building the state will act, and the owner's only remedy is by injunction. The law went into effect July 1st.

The fire marshal's inspectors have so far worked only in the large cities of the state. When this work is completed, the smaller places will be taken up.



Omaha fire-breeders ordered demolished by the State Fire Marshal.

The fire marshal says he finds little opposition to his orders in any city, whether they are to raze or to repair. In many instances wherein repair orders have been issued, the owners have gone further and are tearing down in preparation for the erection of new buildings. In Columbus the work of the state officials is expected to be of great assistance in the enforcement of the building code, which is framed to cover both the fire prevention and sanitation features.

Marshal Zuber has added a new feature to the work in his office which will, in time, become a most valuable one to the citizens of Ohio.

This is the publication each month of a list of buildings which have been inspected and the owners notified either to make immediate repairs or destroy. This will enable city building inspectors to better local fire conditions and assist insurance companies in avoiding the writing of bad risks from both a physical and moral standpoint. The reports for July and August list 880 condemned buildings in Cleveland, Columbus, Cincinnati, Canton, Alliance, Toledo, Lima and East Liverpool, and the September inspections will increase this number by several hundred.

Fire Marshal Ole Roe of Iowa has commenced a crusade against what he terms "ramshackle" buildings in the business sections of Iowa cities and towns. Following inspections, he has issued orders to the councils of a number of cities that some of the fire traps adjoining business blocks must be destroyed. This crusade will extend to every town in Iowa.

The West Virginia Legislature has materially improved the fire marshal law of that state by making it possible for the fire marshal to remove fire traps which are a menace to adjacent property and secure the correction of vital defects in buildings. The tax for the support of the fire marshal department has heretofore been one-half of one per cent. A bill has also been passed reducing the penalty for conviction of arson from life imprisonment to ten or twenty years, except where lives are lost. It is believed that more convictions will be secured under this law, as the life imprisonment penalty was often regarded as unduly harsh by juries.

State Fire Marshal Palmer of Michigan is paying attention to the dilapidated buildings in the large cities of the state which are a menace to the better class of buildings as fire traps, and has ordered a number either torn down and removed or repaired. The Michigan fire marshal law includes the best features of many of the fire marshal laws of the various states. One of these points is that an additional tax is not imposed upon the insurance companies for the maintenance of the department, but the cost is defrayed from the surplus of the insurance taxes and fees, which has heretofore gone into the general fund. The law also has important fire prevention features in addition to the features which require the investigation of fires after their occurrence. The fire marshal, his deputies, the chiefs of fire departments and the mayors of cities and villages where no fire departments exist, together with clerks of townships outside the limits of cities or villages, shall have the right to enter premises at any time to examine their condition, with or without complaint. The fire marshal is to make regulations for the storage, manufacture, sale, transportation or other disposal of highly inflammable materials and explosives, including fireworks. Whenever a building by reason of age, lack of repair or any cause is especially liable to fire and is so located as to endanger other buildings or property, or so occupied that fire would endanger the persons or property therein, he has the authority to require immediate correction. The owner may appeal, but unless on investigation the order is revoked it must be complied with, and failure to comply shall

subject the offender to a fine of not less than $10 or more than $50 for each day's negligence. The department must also require teachers in public and private schools to have one fire drill each month, and keep all doors unlocked during school hours. The law also gives the fire marshal and his deputies complete authority in the matter of securing evidence in cases of arson and incendiarism.

State Fire Marshal Inglish, of Texas, has forwarded letters of instruction to fire marshals of the state, in which he says: "You are authorized to enter and examine buildings and premises where fires have occurred, and it is your duty to inspect quarterly or more frequently, all mercantile, manufacturing and public buildings and premises belonging thereto, and when hazardous or unsafe conditions are found to exist in connection therewith sufficient in your judgment to promote fires, it is your duty to require the removal of such hazards as you may deem necessary for the safety of your city or a portion thereof."

The following states now have state fire marshal laws: Alabama, California, Connecticut, District of Columbia, Illinois, Kentucky, Louisiana, Nebraska, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, North Carolina, Ohio, South Carolina, South Dakota, Tennessee, Texas and West Virginia.

To those who have for so many years labored to awaken the American people to their responsibility for the fire waste, this vigorous work at last undertaken by the states is very gratifying. It must bring almost immediate results, in reducing the number of fire alarms and the losses due to countless fires. The remaining states can hardly retain their complacent attitude of indifference to this vital question in the face of such earnest manifestation to "clean up" by their sister commonwealths.

It may be a "new broom," but it's already doing some sweeping.

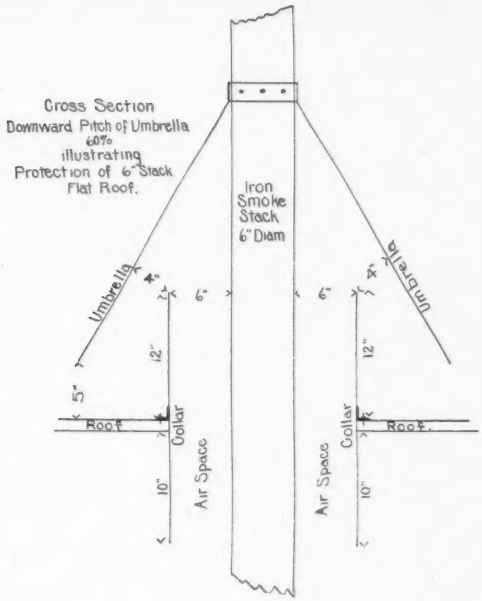


Fig. 1

Protection for Iron Smokestacks.

Through the courtesy of associate member, John S. Eynon, we are able to present the following illustrations and description, showing the methods for the protection of iron smokestacks advocated by the John C. Paige Insurance Agency, Boston, Mass.

The opinion is expressed that, under ordinary conditions, there is little damage to be expected from the effect of heat radiated from the iron stack upon the nearby wood, unless the wood is in actual contact, or close proximity with the stack. The theory upon which this protection for stacks is based depends rather upon the fact that there is a considerable difference in temperature below and above the boiler room roof, which will cause a condensation within the stack at the roof line of the acid products of combustion, especially of the pyroligneous and acetic products. These hot acid products will eventually corrode the stack sufficiently to cause holes. The tendency of the smoke and gases is to pass

SPECIFICATIONS — Unless Double Collar is Specified.

MATERIAL.—Galvanized iron, not less than 18 (American) gauge.

DIAMETER OF COLLAR.—To be at least 3 times diameter of stack or pipe when diameter of stack or pipe is 6 inches or less, and at least 12 inches greater diameter than pipe or stack when such diameter exceeds 6 inches.

DROP OF COLLAR BELOW ROOF.—To bring lower edge of collar at least to level of bottom of nearest joists.

RISE OF COLLAR ABOVE ROOF.—As per table.

DISTANCE FROM TOP OF COLLAR TO UMBRELLA.—As per table.

DISTANCE FROM ROOF TO BOTTOM OF UMBRELLA.—As per table.

Distances named in this table are minimum distances, and may be exceeded but not diminished. Intermediate sizes of pipe take next size larger.

On sloping roofs tabulated sizes to apply to upper side. Such umbrellas are best enlarged on lower side to follow slope of roof.

Diameter of Stack or Pipe.	Diameter of Collar.	Distance above top of Collar to Umbrella.	Height of Collar above (highest) Roof Line.	Distance from Roof (highest part) to bottom of Umbrella.
3 inches	9 inches	3 inches	5 inches	3 inches
4 inches	12 inches	4 inches	7 inches	3 inches
5 inches	15 inches	4 inches	8 inches	4 inches
6 inches or more	18 inches or more	4 inches or more	9 inches or more	5 inches or more

SPECIAL CONDITIONS.—In all such cases apply to local Board of Fire Underwriters for special plan.

Angle of flare of umbrella is optional (sketch shows 60°), but distances named in table are to be observed, as area of opening between top of collar and umbrella and that between umbrella and roof must in all cases EACH exceed area of horizontal cross section of ventilating space between stack and collar.

up the stack in a centrifugal course, seeking an outlet, and a spark will soon find even a minute hole through which it may lodge on the nearby woodwork of the roof. The effect of the collar and umbrella, therefore, is to form an air space of equal temperature at the roof line, through which the air from below can readily pass out of doors, thus reducing the liability of any condensation in the stack at or near this point. The collar is extended below the roof sufficiently to protect the roof joist timbers against the lodgment of sparks.

For stacks of wood-burning or direct flue boilers, where stacks are hot, the double collar and umbrella arrangement is recommended.

The amount of radiation from a stack twenty-four inches in diameter is no more, and if anything less, than from a six-inch stack, hence an air space of six inches is thought to be ample for all sizes above six inches.

Figure 1 shows a cross section of the stack as specified. Figure 2 shows a view of this arrangement. Figure 3 shows a view and partial cross section of a special arrangement for wood-burning boilers.

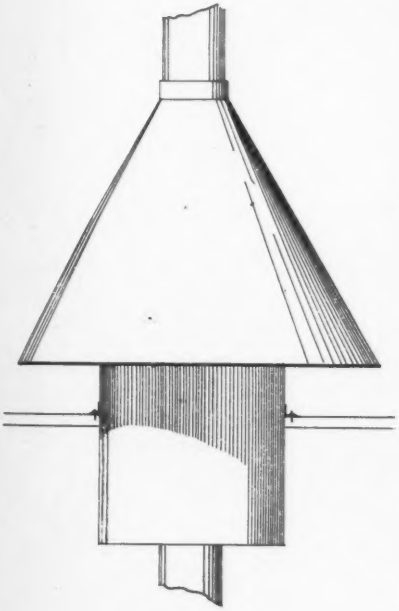


Fig. 2.

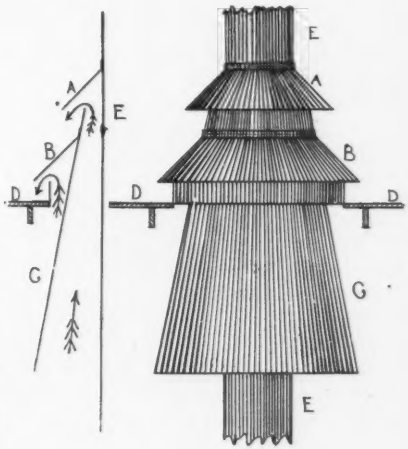
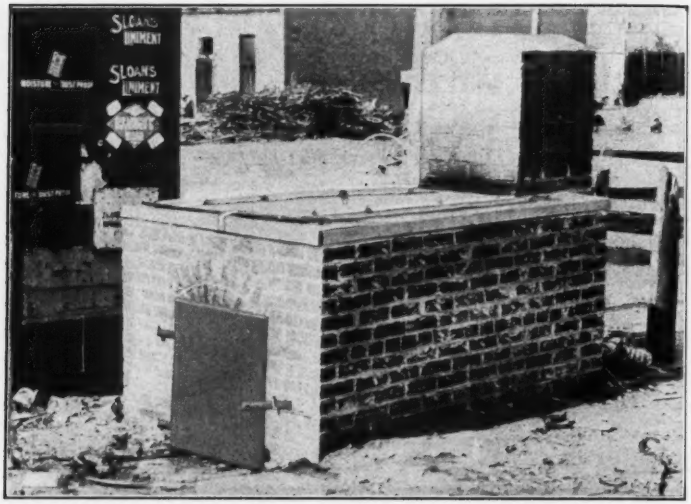


Fig 3.



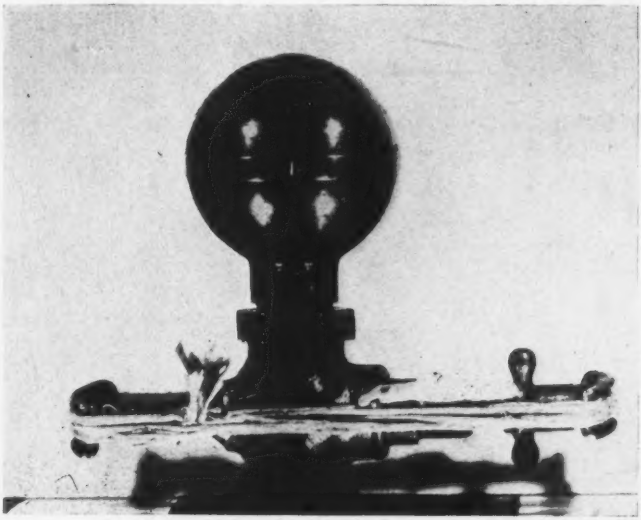
Nebraska Trash Burner

A Practical Trash Burner

The recent burning of the plant of the Woodville White Lime Company at Woodville, near Fremont, Ohio, involving a loss of $150,000, from a fire communicated from a pile of burning rubbish, emphasizes the value of the work of Fire Marshal C. A. Randall, of Nebraska, in urging the merchants of the towns and cities of his state to provide suitable trash burners. Mr. Randall states that according to reports made to the fire marshal's office the burning of paper and rubbish has been the cause of the greatest number of careless fires since the establishment of the office.

On one of his trips recently he was surprised and alarmed to note the unsafe methods by which merchants in the various towns disposed of their rubbish by burning it loose on the ground or in receptacles which offered little protection against flying brands. In one town, however, he found a merchant using a home-made burner which offered a solution for the problem of finding a safe method of disposing of almost all kinds of waste. Besides being safe and effective it is economical. It is a brick, stone or concrete furnace, about four by four by eight feet in dimensions. It has a door in one end and the top is a sheet-iron lid on hinges. The chimney has a wire screen for arresting sparks. A grate is built inside some inches from the ground so as to allow draft. It can of course be used in common by several merchants, and by clubbing on the cost the expense to each is

merely nominal. Mr. Randall is sending out circulars describing these burners, containing the above illustration, which through his courtesy we are able to reproduce. His good example should be industriously followed by other officials. There is no preaching nor writing that is as effective as showing the people "how to do it."



The Conant Automatic Sprinkler

Conant Automatic Sprinkler.

By C. B. Mackinney (Member N. F. P. A.)

The accompanying photograph represents the Conant sprinkler, the picture being actual size. This head was invented by Hezekiah Conant, and patented in 1878. The only installation, as far as we know, being at the works of the Conant Thread Company, Pawtucket, R. I. It consists, as will be seen, of an ordinary one-inch globe valve, the threaded bonnet having been removed and one substituted which contains a stuffing box through which a stem, connected with a valve disc, slides. The outside end of this stem is threaded and on it is mounted a saddle and a set nut. On the other side of the valve is fastened a stationary arm and a corresponding saddle. A band of cotton yarn is placed around these saddles,

and a tension put on it. This holds the valve shut. The deflector consists of a round ball, pierced with holes. A later pattern of this sprinkler had an improvement (?) which consisted of a knife blade on a pivoted arm, from which a cord hung down into the room where the sprinkler was located. The idea being that this cord could be pulled and the knife blade drawn across the yarn, cutting it and thereby opening the sprinkler.

These sprinklers were designed for use in picker rooms, gauze rooms, etc., generally one in each room, regardless of the size or construction, but were very soon discarded at these points, and the old Grinnell type substituted. They were, however, allowed to remain throughout the remainder of the mill buildings for a great many years. We have no record of any operation, successful or otherwise, of these sprinklers. The valve in the sprinkler from which this photograph was taken was so securely stuck together that it had to be taken apart before it could be opened.

This head is of interest as, we believe, it is the only one in existence, the remainder of those which were used in the equipment of the large mills of the Conant Thread Company at Pawtucket, R. I., having all been scrapped when they were discarded several years ago. It is one of the few heads that does not rely on fusible solder for its release; it is the only one we have ever seen with the releasing link made of cotton yarn, and is one of the largest sprinklers we have ever seen, weighing, as it does, two pounds and fifteen ounces.

The objections which would be raised to this device by modern fire protection engineers are obvious, but we are told great faith was placed in it when it was first installed. Compared to the modern sprinkler head it illustrates the great strides that the science of automatic sprinkler protection has taken in the last twenty years, as the weight of the modern sprinkler head is but a fraction of the weight of this cumbersome device. The operating point of the modern sprinkler head is, of course, much lower, it seldom, if ever, fails to act, while on the other hand it was very difficult to open this identical sprinkler head in the laboratory. The modern sprinkler head is also capable of delivering much more water, and covering a much larger space, than the subject of the illustration.

The Wood Pulley as a Fire Hazard.

By L. H. Baker (Member N. F. P. A.)

Fire protection engineers have known for years that when an elevator, equipped with cups for carrying grain, and running over a wooden pulley to which the power is applied, becomes choked or clogged in such a manner as to hold the belt stationary while the pulley continues to revolve, a fire generally results. So many fires in flour mills and grain elevators have been traced to this source that certain insurance companies long ago refused to write mills equipped with wood pulleys in elevator heads. However, definite information on the subject was lacking. No one knew

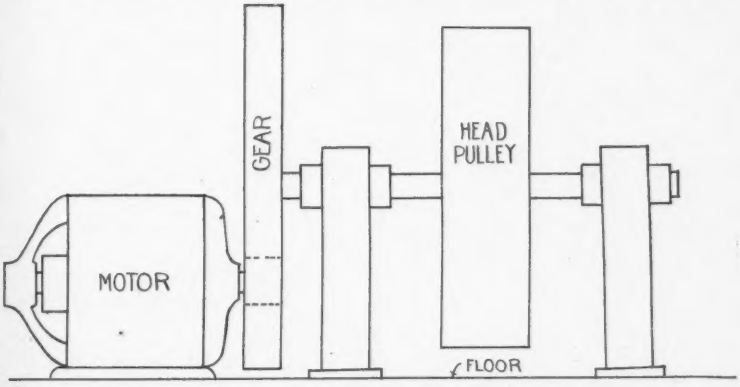


Fig. 1

just how long the pulley would run after the belt stopped before fire ensued, and it was for the purpose of determining this point as accurately as possible that these tests were undertaken.

The apparatus used (Fig 1) in the tests consisted of a horizontal shaft five feet long, supported by two bearings arranged as floor stands. On this shaft were mounted the four pulleys used in the experiments, two of them being wood and two iron, one of each 20 inches in diameter and the other 38 inches, these sizes being in common use in mills and elevators. The power was supplied by a 20 horse power 220 volt, 625 revolutions per minute motor connected with the field in two parts, and operated on a 110 volt circuit, making the normal output of the motor 10

horse power at about 315 revolutions per minute. The motor was geared to the main shaft with a five to one ratio of gears, the internal friction of the apparatus, with belts off, measuring 220 watts. All tests were run with a head shaft speed of 40 to 42 revolutions per minute, this being maintained by keeping the voltage across the brushes of the motor at 83 volts.

The belts used in the tests were bolted to the floor on what would correspond to the loaded or "up" side of the elevator, and known weights (Fig. 2) were hung on both the "up" and the "down" sides of the elevator, representing the actual weight of the belt and empty cups on the "down" side, and of the belt and loaded cups on the "up" side. These weights were on a basis of 10 pounds per inch of width on the discharge side, and 15 pounds per inch of width on the loaded side, in the case of

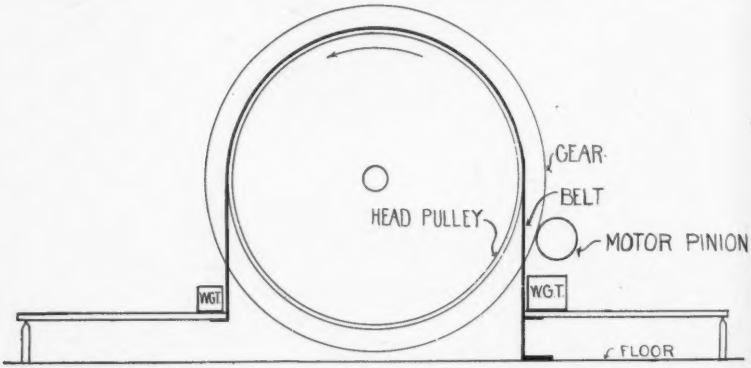


Fig. 2

the 20-inch pulleys; and 10 pounds per inch of width on the discharge side, and 20 pounds per inch of width on the loaded side, in the case of the 38-inch pulleys. New belts were used in most of the tests, but a few tests were run with an old canvas belt taken from a flour mill. In order to make conditions still further approximate those actually existing in a flour mill and elevator, a head was constructed to surround the pulley being tested. This head, or boxing, was supplied with a glass slide at the top for observation, and an incandescent light was placed inside to facilitate close observation.

Recognizing that different materials entering into the manufacture of elevator beltings would produce marked difference in the results, cotton webbing, leather and rubber-covered belts were used on each of the four pulleys, which resulted in three parallel sets of tests. In all, thirty-nine tests were made, six of which were incomplete by reason of the breakage of some portion of the apparatus. The following extract from the notes will serve to illustrate the care with which they were taken, and the general methods employed throughout the tests.

TEST NO. 22.

Four-inch four-ply canvas belt on 38 by 12 inch wood pulley, with face refinished with glue and shellac to approximate as nearly as possible the condition of a new wood pulley.

Tension on discharge side 40 lbs.

Tension on loaded side 80 lbs.

Some of the finish had worn off in previous test, reducing the friction correspondingly.

Started test at 1.42, current 20 amperes.

At 1.43, current 25 amperes.

At 1.44, current 30 amperes.

At 1.46, current 37 amperes. Light smoke visible.

At 1.47, current 42 to 45 amperes. Smoke increasing.

A 1.48, current 65 amperes. Heavy smoke.

At 1.49, current 40 amperes. Heavy smoke.

TEST NO. 37.

Four-inch four-ply canvas belt on 38 by 6½ inch cast-iron pulley.

Tension on discharge side 40 lbs.

Tension on loaded side 80 lbs.

Started test at 12.29, current 10 amperes.

At 12.31, current 10 amperes. No developments.

At 12.38, current 10 amperes. No developments.

At 12.43, current 11 amperes. No other change.

At 12.50, current 12 amperes. No other change.

At 1, current 14 amperes.

At 1.10, current 15 amperes.

At 1.29, current 15 amperes. No developments. Stopped test and examined belt and pulley. The wearing surface of the belt was not discolored, and belt was in as good condition as when test started. Pulley was just warm to the touch.

TEST NO. 29.

Four-inch four-ply rubber belt on 20 by 6 inch refinished wood pulley.

Tension on discharge side 40 lbs.

Tension on loaded side 60 lbs.

Started test at 2.21, current 30 amperes.

In 30 seconds, current 55 amperes. Belt smoking freely.

At 2.22, current 37 amperes. Smoking freely.

At 2.23, current 30 amperes. Heavy smoke.

At 2.24, current 25 amperes. Heavy smoke.

At 2.26, current 17 amperes. Smoke decreasing. Belt badly blistered.

At 2.27½ belt parted. Belt was aglow about 6 inches from point where contact with pulley began. Belt was badly disintegrated, all four plies having parted.

TEST NO. 30.

Four-inch four-ply rubber belt on bright 20 by 6 inch cast-iron pulley.

Tension on discharge side 40 lbs.

Tension on loaded side 60 lbs.

Started test at 2.23, current 12 amperes.

At 2.28, current 13 amperes. No effects visible on belt.

At 2.33, current 20 amperes. No effects visible on belt except that it was hot to the touch.

At 2.36, current 26 amperes. Belt started to squeak.

At 2.37, light smoke visible, squeaking of belt increasing. Current 30 amperes

TEST NO. 38.

Four-inch light double leather belt on 20 by 6 inch wood pulley. Face of pulley was slightly worn.

Tension on discharge side 40 lbs.

Tension on loaded side 60 lbs.

Started test at 4.09, current 9 amperes.

At 4.13, current 9 amperes. Belt beginning to warm up.

At 4.17, current 9 amperes. Very slight smoke.

At 4.21, current 9 amperes. Belt getting hotter. Light smoke.

At 4.25, current 9 amperes. Smoke decreasing.

At 4.29, current 8 amperes. Smoke has stopped.

At 4.33, current 8 amperes. No smoke.

At 4.38, current 21 amperes. Heavy smoke.

At 4.40, current 10 amperes. Belt too hot to bear the hand on it. Smoke decreasing.

At 4.43, current 8 amperes. Smoke decreasing.

At 4.47, current 8 amperes. Smoke barely perceptible.

At 4.54, current 8 amperes. Other conditions remaining unchanged. Stopped test and examined belt and pulley. Pulley showed no signs of wear except that it was polished in spots. It was uninjured in any way by the test. The inner ply of the belt was brittle and a strip along one edge, approximately ½ inch wide, had the appearance of charred leather, except that it retained its yellow color. The remainder of the surface had a number of black spots, although showing no signs of charring. Except for the narrow strip referred to above, the belt was in good condition.

TEST NO. 32.

Four-inch light double leather belt on 20 by 6 inch bright cast-iron pulley. No splice in contact with pulley surface.

Started test at 4.37, current 10 amperes.

In ½ minute, current 20 amperes. Belt squeaking.

At 4.38, current 40 amperes. Belt squeaking. No smoke visible. Belt making a crackling sound as if being bent short.

At 4.39, current 25 amperes. No smoke.

At 4.40, current 20 amperes. No smoke. Belt barely warm to the touch.

At 4.43, current 17 amperes. No smoke or noise.

At 4.48, current 13 amperes. No developments.

At 4.54, current 12 amperes. No developments.

At 5.05, current 11 amperes. No developments.

At 5.37, current 11 amperes. No developments.

Test was stopped and belt and pulley examined. Belt was too hot to bear the hand on it, and had taken on a high polish, but showed little sign of wear. The pulley was warm but not hot.

Tabulation by Groups.

1. Canvas belt on 38-inch iron pulley.	Test No. 37. Belt only slightly warm at end of 1 hour.
2. Canvas belt on 20-inch iron pulley.	Test No. 26. Belt only slightly warm at end of 1 hour.
3. Canvas belt on 38-inch wood pulley. (Pulley face refinished.)	Test No. 21. Smoking hot in 2 minutes, incomplete. Test No. 22. Belt aglow entire length in 20½ minutes.
4. Canvas belt on 20-inch wood pulley.	Test No. 25. Smoking in 1 minute. Belt aglow in 10½ minutes.

5. Rubber belt on 38-inch iron pulley.	Test No. 36. Smoking hot in 21 minutes. Belt uninjured in 1 hour.
6. Rubber belt on 20-inch iron pulley.	Test No. 30. Smoking hot in 14 minutes. Belt uninjured after 1 hour.
7. Rubber belt on 38-inch wood pulley.	Test No. 23. Smoking hot in 1½ minutes, incomplete. Test No. 27. Excessive power required to slip belt, incomplete. Test No. 28. Smoking hot in 30 seconds. Belt broke in 8 minutes. No fire.
8. Rubber belt on 20-inch wood pulley.	Test No. 29. Smoking hot in 30 seconds. Belt broke in 6½ minutes. Belt aglow.
9. Leather belt on 38-inch iron pulley.	Test No. 33. Belt uninjured, but excessive power required to slip it. Test No. 34. Belt hot, but uninjured after 1 hour.
10. Leather belt on 20-inch iron pulley.	Test No. 32. Belt hot, but no smoke after 1 hour.
11. Leather belt on 38-inch wood pulley.	Test No. 24. Smoke in 1 minute. No fire after 1 hour. Test No. 35. Smoke in ½ minute. No fire after ½ hour.
12. Leather belt on 20-inch wood pulley.	Test No. 31. Smoking hot in 1 minute. Splice opened, but no fire. Test No. 38. Smoking hot in 8 minutes. No fire after 45 minutes.

Conclusions.

The experiments proved that the only safe combination is the canvas belt on an iron pulley. Fire was produced invariably in the tests where either canvas or rubber-covered belts were used on wood pulleys, except where belt broke before point of ignition was reached, while it was found that the leather belts would invariably break before the point of ignition was reached.

Increasing the pulley speed or increasing the tension on the belt undoubtedly increases the hazard.

The tests with rubber belts on wood pulleys indicate that this is a very dangerous combination. Even the matter of surface of the wood pulley is not of any material consequence, for the reason that as soon as the rubber belt gets hot, the rubber seems to coat the surface of the wood pulley, and increases the friction about as much as the shellac would increase it.

Water Barrels and Pails for Fire Protection.

By W. R. Ruegnitz (Member N. F. P. A.)

In lumber yards, warehouses, special hazard and other properties where more sightly appearance in apparatus is not required, water barrels and pails properly maintained constitute valuable and effective fire protection. Many properties, however, which should have such protection and which would be benefited thereby are without it, and many others which have installed such equipment maintain it imperfectly. The defects commonly found are listed below, and the suggestions following are submitted as a guide to more effective maintenance and use.

Defects.

1. Number of barrels and pails insufficient.
2. Barrels and pails empty, and only partially filled, or with contents frozen.
3. Barrels and pails out of repair.
4. Pails removed from proper location.
5. Barrels and pails inconspicuously located, or covered by stock of materials, or difficult of access.
6. Barrels not covered, or poorly covered.
7. Owner's inspection of barrels and pails infrequent or irregular.

Suggestions for Arrangement and Maintenance of Water Barrels and Pails for Fire Protection Purposes.

Ordinary wooden barrels of about 50 gallons capacity, being generally used and most commonly obtainable, are suitable under ordinary conditions. Pails should be of galvanized steel, conforming to the Rules and Requirements of the National Board of Fire Underwriters as recommended by National Fire Protection Association.

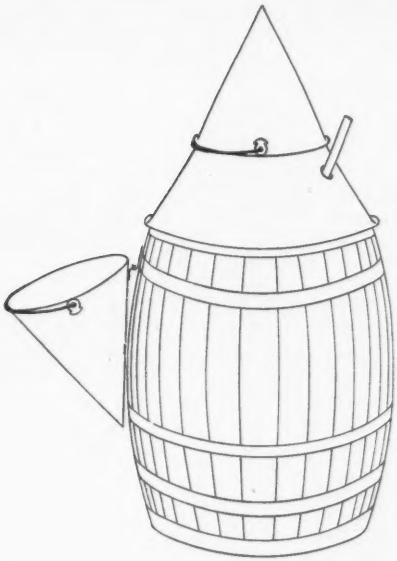
Reference is had to the accompanying drawing of water barrel, cover and pails.

Number and Distribution of Barrels and Pails. The number of barrels to be installed is subject to the requirements of Underwriters having local jurisdiction, but in cases where ruling has not been made the following is suggested:—

Within buildings, provide not less than one barrel and two pails for each 5,000 square feet floor space.

In yards, provide not less than one barrel and two pails every 100 feet in each lane or alley.

Where pails are installed without barrels, see published Rules and Requirements of the National Board of Fire Underwriters as recommended by National Fire Protection Association.



SUGGESTED WATER BARREL
Pails, Cover & Stake.

Barrels Exposed to Freezing. Where exposed to freezing, barrels should be filled with a solution of common salt or of calcium chloride of density required for temperatures obtaining. The solution may be prepared according to the following tables:—

COMMERCIAL CALCIUM CHLORIDE

Pounds Per Gallon	Freezing Point Degrees Fahrenheit
½	29 above zero
1	27 " "
1¼	25 " "
1½	23 " "
1¾	21 " "
2	18 " "
2¼	14 " "
2½	4 " "
3	15 below zero
3½	6 " "
4	17 " "
4½	27 " "
5	39 " "
5½	54 " "

COMMON SALT (SODIUM CHLORIDE)

Pounds Per Gallon	Freezing Point Degrees Fahrenheit
½	24 above zero
1	18 " "
1¼	15 " "
1½	12 " "
1¾	9 " "
2	6 " "
2¼	3 " "
2½	1 " "
3	3 below zero
3½	8 " "

The solution should be mixed in a vat before being placed in barrels, care being exercised to see that the salt is entirely dissolved. If dumped into a barrel and covered with water, or if thrown into a barrel of water, the salt will be only partially dissolved and unsatisfactory results obtained.

Calcium chloride is said to be superior to salt in the following respects: it does not corrode steel tanks and barrel hoops; it has no odor and will remain odorless even if left standing for a long time.

Where calcium chloride solution is used, wooden barrels should first be well coated inside with asphaltum or with a mixture of crude paraffin and resin to prevent shrinking of staves and consequent leakage.

Where common salt solution is used, barrels with wooden hoops should be provided, as salt will corrode steel hoops or steel tanks.

To Prevent Removal of Pails. To prevent removal or theft, pails hung at barrels should be made unfit for any but fire protection purposes by punching a one-eighth inch nail hole in the bottom of each.

Proper Arrangement of Barrels and Pails. Barrels within buildings should be uniformly distributed, and should be placed as follows:—

At entrances, at exits, at stair and elevator landings, at exterior wall openings readily accessible from both outside and inside, in aisles at floor posts, in aisles against partitions clear of stock and materials, or in aisles along walls clear of stock and materials.

The purpose of such location is to assure prominence, ready access, permanence and knowledge of equipment by occupants.

Barrels in yards should be in straight rows, especial care being taken to place each barrel prominently, avoiding niches between piles of stock or materials. All the barrels in a lane or alley should, if practicable, be visible from either end of the row.

Pails should be hung in view outside the barrel, and the arrangement of barrel, cover and pails should be uniform, so that disarrangement or removal of pails will become readily noticeable.

Color of Barrels and Pails. Barrels, covers and pails should preferably be whitewashed or painted white, although if placed against a white background and in a location well illuminated day and night red may be all right. Bright galvanized iron might be effective left unpainted in lieu of whitewashing or painting white.

NOTE.—Barrels and pails have commonly been required to be painted red to indicate their use for fire protection purposes. When painted any color but white, however, they become much less readily visible at night; and, in dimly lighted occupancies, such as warehouse storage rooms, are often rendered inconspicuous and hard to find even in day time.

NOTE.—The following whitewash formula is recommended by the Lighthouse Board of the United States Treasury Department: "Slake one-half bushel unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when

used put it on as hot as possible with painters' or whitewash brushes. Where possible the coatings, should be applied by a hand-brush rather than by a spraying machine, thus effecting a better surface."

Barrel Covers and Pail Holders. Barrels should be kept entirely filled with liquid contents at all times. To prevent evaporation of contents, barrels should be provided with reasonably tight covers, preferably so designed as to hold pails in view outside barrels. Such covers should be of conical or of truncated conical shape, instead of flat, in order to prevent their use as tables or shelves. Stock or materials are often placed upon flat covers, thus obstructing access for inspection, refilling, or use in case of fire.

NOTE.—Calcium chloride in solution is said to be less subject to evaporation than water or salt brine, and where used the labor of re-filling will be minimized.

Stake in Each Barrel. To facilitate the inspection of barrel contents a permanent stake should be set in each barrel, projecting through an aperture in the barrel cover. This renders it unnecessary to remove the pails and cover except in refilling.

Rules to be Posted. The following Rules should be printed in red type at least one-half inch high and attached to barrels or included with posted fire instructions:—

Barrels are to be kept full at all times. Barrels found empty or running low or frozen should be reported at once to ——.

Pails must never be removed for any but fire protection purposes. Where pails are missing, report at once to ——.

Inspection of Equipment. Regular and frequent inspection of equipment should be made by owner to ascertain that the barrels and pails are in proper condition. Under ordinary conditions this should be not less often than once each week. To facilitate reporting defects and making repairs barrels should be numbered, and where the number exceeds fifty barrels should be numbered and charted. Inspection and maintenance should be entrusted only to a competent employee.

Fire Protection of Chemical Laboratories.

In an issue of *Science* sometime since there was an article entitled "Suggestions for the Construction of Chemical Laboratories," by Prof. Augustus H. Gill, of the Massachusetts Institute of Technology. In this article, under the heading of "Fire Walls and Protection," he describes methods of fire protection so nearly in accord with the accepted practice of fire protection engineers, and so well adapted, with slight modifications, as standard requirements for chemical laboratories, that it seems worth while to quote this portion of his article for the benefit of QUARTERLY readers. It is indeed gratifying to find an awakening interest among men not directly interested in fire protection, and especially among a class of professional men sometimes accused of being more theoretical than practical, who have it in their power to inculcate many valuable ideas regarding the value of fire protection in the minds of the young men with whom they come in contact. A footnote in the article quoted states that it was practically in its present form in November, 1907.

Fire Walls and Protection.

The building should be sub-divided into areas of suitable size by fire walls extending from top to bottom; all apertures in these walls should be guarded by automatic fire doors. The library, if there be a departmental one, should be housed in a fireproof room and also be protected from being flooded by leaks on the floor above. The more dangerous laboratories—the organic, the oil testing. and those below or adjacent to the library should be rendered safer by the installation of sprinklers. Somewhere in the building there should be a fireproof room for the distillation of inflammable substances. In addition to fireproof stairway a sufficient quantity of outside iron fire escapes should be provided and the exits thereto carefully indicated and kept unfastened. . . . Fire hose with nozzle should be provided in each laboratory. . . . A number of small hose are better than large hose in the hallway, in that they are more accessible and if used do not deliver such a torrent of water as to occasion a greater loss from water than from the fire itself. Pails of sand with scoops are very efficient and should be found in every laboratory. No money, however, should be wasted on the purchase of "dry powder fire extinguishers," of which Dr. Freeman says, "We recommend that they be thrown into the rubbish heap." If these are wanted they can be easily made by filling tin tubes with two or three pounds of "Anchor Dust" or waste bicarbonate of soda. In the organic and oil testing laboratories, or any other where the fire risk is unusual, in addition to the safeguards above mentioned and automatic sprinklers, some type of portable chemical fire extinguisher should be employed. This . . . . throws a stream of carbonated water, which is especially effective in tar and chemical fires.

A large douche bath with quick opening valve has been found very convenient in extinguishing fire in a student's clothing. This is merely a rose or better a flat hollow disk, a foot in diameter, with concentric slits in it, through which the water issues in a shower; it is set seven feet from the floor.

Department of Fire Record

J. ALBERT ROBINSON, Superintendent.

The Cotton Warehouse Fire Record.

A study of this record discloses three important facts:—

First, that the typical American cotton bale, owing to the inherent susceptibility to fire of cotton itself and the antiquated American method of baling, is a most prolific source of trouble. Our records show over seventy per cent of the fires due to these causes. Almost without exception the cause of cotton fires, at least the inherent avidity with which cotton fires develop from a small source, is due to the wretched method of American baling.

Second, that the method of warehousing and storage is a very important factor governing the severity of a fire and the amount of loss; far more so, and of much more importance than the storage problem of many other classes of goods.

Third, that the question of salvage enters prominently into the methods of handling cotton warehouse fires, and complicates almost every loss.

We have, therefore, discussed these three phases of the question at some length, with a view to assembling the matters of interest pertaining to this subject, as well as with the desire of applying the results of the study of our fire record to the case in hand.

Many interesting deductions might be made from a careful perusal of the record, which we have left for the reader who may be particularly interested to study the subject further.

COTTON BALE FIRES.

It is a well known fact that fires, which we have termed "typical cotton bale fires," and which comprise nearly one-half of all fires reported in our Cotton Warehouse Fire Record, are smouldering fires. A spark which may find lodgment in a bale of cotton, may set up a slow smouldering combustion almost imperceptible for many days and even weeks; in fact, cotton which has been scorched has been kept under water for many hours, and when brought out, after a little exposure to a hot sun, has again commenced to burn. It will not burn while the exterior fibre of the bale is at all damp, or where there is insufficient oxygen to feed combustion, but when the conditions are favorable a fire which may have

been a long time incipient will break out. Besides these typical cotton fires, a certain percentage can always be traced directly to sparks from a known source, the fire occurring shortly thereafter. In our record, ten per cent of all fires were caused by sparks from locomotives, nearby chimneys, or sparks which were packed in the cotton at the gin, after a fire had occurred at that point. Another important source of fire, to which over twelve per cent of our fires were attributed, is the match. Matches are dropped from pockets of employees, and afterwards stepped on or run over by truck wheels; or they get into the bale during the baling processes or during transportation, and are ignited by rats accidentally biting them while getting nest material.

There is nothing that so well illustrates the scandalously careless methods prevailing throughout this country in matters pertaining to protection of property against fire as the covering and handling of cotton bales. An excellent example of typical American baled cotton may be seen in the frontispiece of this issue of the QUARTERLY.

Our associate member Mr. Benjamin Richards, at our annual convention in May, 1907, presented an able paper entitled "The Cotton Bale as a Source of Loss by Fire." In this paper he reviewed the fire record of cotton fires and their causes. He described in considerable detail the various types of American bale and compared them with the much superior foreign bales. The following suggestions concluded his paper:—

1. Underwriters should realize the great difference in losses between foreign and American baled cotton. Statistics show that Egyptian cotton is a more favorable insurance proposition than are gray print cloths in bales. Rating organizations should differentiate favorably for Egyptian or Indian cotton against the American compressed bale. Inspectors should point out the differences in hazard between the classes of cotton bales and demand the isolation of that which is improperly baled.

2. No American cotton as at present baled should be insured when piled in mill yards, on platforms, or when in transit, unless properly protected against sparks.

3. A density of forty pounds per cubic foot should be required in the bale.

4. The shape should be similar to the Egyptian bale with the pressure applied at the compress to the side with the lesser area.

5. A complete covering of closely woven burlap or cotton canvas should be required.

6. There should be a larger number of ties with improved buckles. There should be, in fact, the equivalent of a "National Standard" cotton bale,—one that, in contrast to our present bale, will be fairly safe from loss by fire and, as well, a credit to American industry.

At the time this paper was prepared there appeared to be a growing interest among cotton growers, as well as cotton manufacturers, to improve the American cotton bale. It received gratifying publicity and was quoted at length in most of the leading textile journals of the country.

Up to the present time, however, there appears to have been little if any general improvement in the methods pursued. One of our correspondents, who is in close touch with the cotton interests, writes: "There is absolutely no improvement of any kind or description, and the way

cotton is handled at this time might almost be termed criminal." There are, however, several types of improved bales on the market to-day and in use at isolated points here and there. An example of such is shown in the accompanying illustration. We cannot look for a great reduction in the number of cotton fires until bales of this type come into general use. It is also fair to state that there is a decided growing sentiment in favor of improved baling among the Southern cotton planters. The Farmers' Union is already interesting itself in this movement. Mr. Harvey Jordan, the official head of the Southern Cotton Association is conducting an active campaign for improvement. The fact that the large compress companies have large sums invested in machinery and plants, that there has been a mechanical problem to solve, and that the transportation interests have not encouraged the movement, should be taken into consideration. Fire protection engineers and fire insurance interests should make every effort to hasten the introduction of improved methods of baling cotton.

NEELY BALE
Weight, 505 Lbs.
48 in. x 18 x 30.
Density, 30⅘ Lbs. to Cu. Ft.

BEST TYPE GIN-BOX BALE
Weight, 445 Lbs.
54 in. x 35 x 40.
Density, 10.2 Lbs. to Cu. Ft.

COTTON WAREHOUSES.

Experience shows that the safest and most economical way of handling cotton is to store it in low, one-story warehouses of limited area, the sections being preferably not more than fifty by one hundred feet in size, and each section separated from those adjoining by standard blank parapeted fire walls. These parapets should extend three feet above the roof, and the wings should extend out three feet. The wings may be replaced by a T-wall at each end of division wall, the T being at least ten feet long or five feet each side and at right angles to the division wall. This should only be done, however, where conditions will not allow of wings. Some favor compartments containing 6,600 square feet, in which 600 bales may be stored. In public warehouses compartments sufficient to contain 1,000 bales are used. One large organization limits the storage in each compartment to a value of $50,000. Warehouses have been constructed all the way from one compartment to a group of 80. The end walls should be of brick, if there is any exposure within 100 feet, but there should be ample door openings protected by standard fire doors. If there is no exposure, the end walls may be of wood, constructed of clapboards put on in such a manner as to offer security against inclement weather or sparks. The wooden walls are frequently pulled out in case of fire, which facilitates the removal of the burning bales. Floors should be of concrete or other fire-resistive material; roofs of light mill construction with eight or ten foot bays are recommended but not generally insisted upon in standard warehouses. If it becomes necessary to build warehouses more than one story high, the floors should be water-tight and arranged to drain with scuppers at the sides. The approved method of storage is to stand bales on end one bale high. To insure this method of storing, warehouse roofs should preferably be seven or eight feet high and not over eleven feet high. Care should be taken to maintain a clear space of about three feet between the top of the storage and the sprinkler heads, so that in case of fire there will be ample room for the sprinklers to operate, and they will not be obstructed by the storage. There should always be left passages four feet wide extending from end to end opposite the doors in the end walls.

Warehouses should be equipped with automatic sprinklers arranged under the dry-pipe system, so that the sprinkler system will be in commission throughout the year. Sprinklers should be spaced a little closer than the rules ordinarily require, allowing an average of 80 square feet of surface per head. From 25 to 50 per cent more sprinklers should be installed under roofs of open joist construction than under mill construction. Where the wooden ends or sides are used, it is recommended that a line of sprinklers be placed close up under the eaves with the curtain board extending down slightly. If cotton on the platform contains fire, and beats against the wooden sides, these automatic sprinklers will operate and form a water curtain, and as many warehouses do not employ a

watchman, such an arrangement is better than the regular open sprinkler system. It is very important that water supplies should be ample and of high pressure to insure positive results. Our statistics show that in only 52 per cent of the fires less than ten heads were opened, whereas the average given in the annual tables shows that 81 per cent of all our sprinkler fires is extinguished with ten heads or less. Most striking of all, however, is the fact that in 23 per cent of these warehouse fires, from 25 to 49 heads were opened, whereas a summary of our total fire record shows that only in three and one-half per cent of the fires did this number of heads open, and that 30 per cent was extinguished by one head. The average number of sprinklers opened in each fire, not including unsatisfactory fires, was 13.5. The average for cotton mills was 6.2, and for mattress factories the average was 4.6.

It has been demonstrated in many fires that with the cotton storage handled in this manner, sprinklers can be relied upon to control the blaze.

Many of the disastrous cotton warehouse fires have been directly attributable to the cotton being piled so high that the sprinklers could not reach the fire, for in general the effectiveness of the sprinkler protection decreases in direct ratio with the piling of the cotton, and, furthermore, the sprinklers have great difficulty in extinguishing or holding a fire in check, as the bales in the upper tiers seriously obstruct distribution of the water. It is the practice in many warehouses to lay the cotton on side and pile it four or five bales high, or even higher. Under this arrangement, the sprinkler protection is reduced very largely to a mere matter of chance and one cannot tell whether a big loss or a small one will result. If the bales are piled in such a way that the spaces are not broken, it is possible for one sprinkler to catch a fire in the lower tier of bales; but if, on the other hand, cotton is put in, as it usually is, so that the spaces between the bales in one tier are covered by the cotton in the tier above, then there is no knowing where a fire will show on the surface which has started in the bottom tier of cotton. Under the standard arrangement of one bale high on end, other conditions being equal, practically every fire is caught and held to a small amount.

An attempt was made to analyze, from the data contained in our fire record, the effect of piling bales several tiers high as compared with storing one bale on end; and the relations between bales in room, bales involved in fire, and per cent of loss in bales involved in fire. Nineteen returns showed that small losses occurred only where bales were piled three high and less. There were only two losses over $1,000 in that class, while six losses over $1,000, averaging $7,000 each, occurred where bales were piled five deep and more. In 24 fires, where both number of bales in room and bales involved by fire were reported, the average bales in a room were 580, and the average involved by the fire 74, or 13 per cent of the bales exposed. The returns were not sufficient to show the percentage of loss to bales involved. This involves the important feature of salvage.

SALVAGE.

Bales should be removed from the warehouse just as quickly as possible, even though they may be burning, for the burning is not apt to be in the form of flames, but merely as a sort of charring which continues until the fire is extinguished. In many cases the sprinklers do yeoman service in holding the fire within small bounds, but other means must be used for final extinguishment, if any considerable amount of salvage is to be expected. The percentage of fires practically extinguished in this class is 48 per cent as against nearly 64 per cent, which was the average given for all classes in the last annual tables. The average unsatisfactory sprinkler fires for all classes is about 5 per cent, while in this class it was 12 per cent. Each bale should be taken off by itself and the fire extinguished in it by cutting out with a knife the bits of burning cotton. The bales should then be washed. The ties on a bale of burning cotton should never be cut, because if they are the whole bale is liable to be consumed. Outside fire protection equipment is found to be very important in the extinguishment of smouldering fires. In our record 55 per cent of the fires was finally extinguished, or at least the extinguishment was greatly aided, by outside hose streams.

Cotton Warehouses—Fire Record.

Total Number of Fires, 116.

1. CLASSIFICATION OF CAUSES.

Summary.

Common Causes.

	No. of Fires.	Per cent of Common.	Per Cent of Whole.
Matches	14	46.5	12.2
Sparks	6	20	5.2
Lightning	5	17	4.3
Carelessness	3	10	2.6
Smoking	2	6.5	1.7
Total	30		26

Special Hazards Causes.

	No. of Fires.	Per Cent of Special Hazards.	Per Cent of Whole.
Typical Cotton Bale Fires	56	86	48.3
Spark from Gin	5	8	4.3
Spontaneous Combustion	4	6	3.5
Total	65		56
Incendiary	1		.8
Exposure	1		.8
Cause Unknown Fires	19		16.3

Details.

Common Hazards.

Matches 14
- Matches on the floor and stepped on 5
- Rats and matches 3
- Matches in cotton bales 3
- Truck ignited match on floor 1
- Careless disposition of lighted match 1
- Small boy who was striking match on a band buckle 1

Sparks 6
- Sparks from passing locomotive 2
- Spark from locomotive reached cotton through hole cut in wall of storehouse 1
- Sparks from switching engine ignited cotton on warehouse platform 1
- Spark from nearby dwelling 1
- Spark from fireworks or fire cracker 1

Lightning 5
Caused severe flash fire 1
No details 4
Carelessness 3
Carelessness of employees repairing elevator machinery 1
Accidentally by employees 2
Smoking. No details 2

Special Hazards.

Typical Cotton Bale Fires 56
Details mostly very similar. Fires broke out in bales of cotton sometime after storage from no apparent recent cause 55
Possibility that the sunlight might have focused on cotton in storehouse through a large skylight directly over the burned cotton 1
Sparks from Gin 5
Fire in gin just previous to removal of cotton to storehouse. Fire broke out shortly thereafter 3
No details 2
Spontaneous Combustion 4
Oily waste 1
Occurred around some loom harnesses 1
In cotton 2

Exposure.

Started in cotton bales piled in yard and communicated to storehouse ... 1

2. MISCELLANEOUS STATISTICS.

Location.

Warehouses located at manufacturing plants, 84.
Storage and custom warehouse, 32.

Geographical Distribution.

Southern.		New England.	
South Carolina	46	Massachusetts	8
North Carolina	15	New Hampshire	3
Georgia	15	Rhode Island	2
Alabama	8		—
Mississippi	2		13
Texas	2		
Arkansas	2	New York	5
Virginia	1	Pennsylvania	3
Louisiana	1	Ohio	1
Tennessee	1	Canada	1
	—		—
	93		10

Type of Warehouse.

Covering 90 fires. No data given, 26.

Standard warehouses	35
Non-standard warehouses	33
Type not reported	22
Height one story	38
Height two or more stories	22
Height not reported	30

Number reporting more than one compartment, 37, of which 19 were reported as standard warehouses.

Average number sprinklers in room	55
Average number sprinklers on dry valve	242

Outside protection equipment was used in fifty-five per cent of the sprinklered fires. Private protection equipment was used in fifty per cent, and public protection equipment in five per cent of these fires. Both public and private protection equipments were used in twelve per cent.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Outside	3	11	1	2	1	7	5	5
Basement	1	4	..	..	..	..	1	1
First floor	8	30	26	49	10	66	44	46
Above first floor	3	11	12	23	1	7	16	17
Inside, but no definite location given	12	44	14	26	3	20	29	31
Total with data given	27		53		15		95	
No data	3		12		6		21	
Total	30		65		21		116	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	20	67	26	41	8	38	54	46
Night	10	33	38	59	13	62	61	54
Total with data given	30		64		21		115	
No data	..		1		..		1	
Total			65				116	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation .	15	56	18	30	5	26	38	36
Plant not in operation	12	44	42	70	14	74	68	64
Total with data given	27		60		19		106	
No data	3		5		2		10	
Total	30		65		21		116	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	16	53	20	31	6	29	42	36
Watchman	8	27	16	25	5	24	29	25
Thermostat	..	..	..	..	2	9	2	2
Sprinkler Alarm .	3	10	14	21	3	14	20	17
Outsider	3	10	15	23	5	24	23	20
Total	30		65		21		116	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent of Whole.
Extinguished or practically extinguished fire	44	48
Held fire in check	35	38
Unsatisfactory	11	12
Fire extinguished before sprinklers operated	2	2
Total	92	
No claim	9	10
Small loss $250 and less	34	37
Between $250 and $1,000	22	24
Between $1,000 and $5,000	14	15
Between $5,000 and $10,000	6	7
Over $10.000	7	8
Total	92	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

3454. January 18, 1905. At 5.40 a. m. one of the mill hands while passing through the yard saw fire coming from Compartment No. 3 of warehouse. He notified the foreman of the fire department, also the master mechanic, who immediately gave the alarm by blowing the whistle. The fire brigade responded and five hose streams were brought into play. The building was equipped with automatic sprinklers, but the water from same had been shut off on account of the cold weather. Water was shut off the sprinklers in this warehouse from December 1st to March 1st. As soon as possible the water was turned into the sprinkler equipment, but meanwhile the fire had worked through all three floors of the building and through the roof. After three hours' work the fire was practically extinguished, having been confined to the compartment in which it originated.

The compartment contained 301 bales of cotton, 70 bales of sheetings and shirtings, also 169 bags of starch, and other supplies. All of the cotton was considerably burned, some very badly. The bales of cloth were wet and many of them scorched and burned.

The brick fire walls on each side of this compartment were uninjured and no damage occurred to compartments on either side. Three-quarters of the woodwork in No. 3 had to be replaced.

It was evident that the fire had been smouldering for a long time and had gained great headway before being discovered. This was indicated by the fact that all of the 230 sprinklers in the building were opened when the water was let into the sprinkler system. After the fire was discovered, the mill fire department did most excellent work in putting out the fire and saving contents of the building.

Loss estimated $10,000 to $12,000.

Summary: Water shut off sprinkler system during cold weather.

3967. June 27, 1905. This was a one-story end compartment of a standard warehouse, fifty by one hundred feet, with parapeted brick side walls, sixteen inches thick on one side and twelve inches on the other. Frame ends covered with one-inch boards. Floor was three-inch plank. Roof was two-inch plank supported by eight by ten inch timbers.

Warehouse was sprinklered on the dry system. Primary supply was waterworks. Secondary supply consisted of gravity tank and steam pump draughting from private reservoir.

On morning of day of fire, plant was notified that waterworks would be shut off for the day. At about 4.30 p. m. a man who was wheeling a bale of cotton into warehouse on a truck, stated he heard a match strike and immediately flames shot up behind him. The fire spread with great rapidity and city department was called. In the meantime mill pump was started and six or seven streams were thrown on the fire. Pump did not furnish any water to the sprinkler system. No water was seen to issue from the sprinklers. Superintendent was confident that the tank was full,

but valve was found shut after the fire. There was absolutely no indication of sprinkler work in the building. The plank ceiling burned away sufficiently to allow the pipe hangers and piping to become detached. Loss on building $1,000, contents $3,000.

Summary: Water shut off.

5487. November 23, 1906. One-story frame iron-clad warehouse used for the storage of cotton bales only. Fire was discovered about 1.30 a. m., and at that time it was coming through the roof of the warehouse.

Risk was equipped with Grinnell sprinklers, dry pipe system, supplied by a 10,000-gallon tank giving about twenty-five pounds pressure on the sprinklers in the warehouse. Second supply was a 750-gallon pump. Watchman had rung the station on the outside of the warehouse every hour regularly, but had not discovered the fire. It was discovered by a mill hand in dwelling nearby who gave the alarm. When engineer arrived he found no water running from the sprinklers and the tank at that time was empty. It is believed, however, that the tank was full and had been drained. Pump was started, but it was found that one of the large pipes in the storehouse was broken so that the sprinkler system was at once shut off and the pump supply reserved for hose streams. Fire was finally controlled by the use of hose streams after about 75,000 gallons of water had been used from pump cistern. Subsequent investigation seemed to prove that water was on sprinklers when fire started, that dry valve operated properly and that fire was probably held in control until tank was exhausted, this happening before fire was discovered. Dry valve was provided with water motor alarm, which was probably shut off at time of fire and therefore did not operate.

Loss about $3,500.

Summary: Small gravity tank for primary supply. Was soon drained and fire gained headway before discovery.

6054. April 21, 1907. At 10 a. m. a fire was discovered in a pile of cotton in the yard containing 863 bales of cotton and located about six feet from the cotton storehouse. The fire spread into the storehouse in which 975 bales of cotton were stored. Eight hose streams were immediately used, supplied by steam and rotary fire pumps. Thirty-five sprinklers opened in the storehouse, but failed to hold the fire. About 175 bales of cotton in the building were scorched and partially burned and the greater portion of the remainder of the bales were thoroughly wet. The cotton in the yard was badly burned and damaged by water. The roof and two sides of the storehouse were more or less damaged.

During the fire it was noticed that the water flowing from the sprinklers was not sufficient. Examination after the fire developed the fact that the side pipe was undoubtedly obstructed, and four heads at the end of the lines on the northerly side were filled with gravel.

Loss on storehouse and contents was estimated at from $10,000 to $12,000.

Summary: Sprinkler pipes clogged.

6549. January 2, 1908. Two-compartment, three-story, standard warehouse. Each section fifty-two by fifty-four feet. Fire occurred at night and was discovered by the watchman. Building was equipped with Grinnell glass disc sprinklers, thirty on each floor; old standard spacing and arrangement; wet system supplied by a 50,000-gallon reservoir, giving about eighteen pounds pressure on sprinklers, and a 1,000-gallon rotary pump. The pump was something like 140 feet beneath the level of water in the reservoir, and owing to friction in pipe, the gauge on pump showed nearly seventy pounds when pumping full capacity into the reservoir. The water in reservoir was not over twenty feet above the sprinklers in the warehouse. There was an open hatchway about eight feet square in both floors of warehouse and on second floor a line of three sprinklers had been disconnected, leaving one bay between hatchway and side of building unprotected. The fire started in the lower story, and as the system was dry, the flash spread before water was discharged from heads. The flames passed up through hatches and generated heat enough to open probably every one of the ninety heads, all of which were on a three-inch riser. The result was insufficient pressure for effective distribution. The pump was in operation twenty-five to thirty minutes after fire started (may have been less time), and a hose stream run from hydrant near mill. Upon taking another hose stream from hydrant on hill in front of warehouse, water could barely flow from nozzle. Later sprinklers were shut off and three good strong streams were thrown and two to three streams kept on fire all night.

Loss on building $2,521, on contents $31,777.

Summary: Floor openings.

7095. March 6, 1908. A complete description of this fire was given in the July, 1908, QUARTERLY, Volume 2, No. 1, page 105.

A large loss resulted from obstructions to distribution, caused by cotton bales piled nine high on sides.

7451. May 9, 1908. Fire said to have been of incendiary origin. No evidence that sprinklers operated. Tank was said to have been full. If this were so, the water was shut off.

Loss on building $1,630, on contents $9,560.

7918. August 23, 1902. At 3.30 a. m., during a severe tempest, lightning struck the west end of cotton storehouse No. 4. There were about 3,200 bales of cotton in this section and the fire spread rapidly over the pile. The building being of very light construction, the west half was soon consumed, and the middle section of the roof throughout its whole length was burned up to the brick fire wall which separates the west from the central compartment. The watchman was stunned, but not seriously injured. He quickly gave the alarm to the fireman in the pump house, who immediately started the pumps discharging water into the sprinkler system. Workmen living nearby quickly responded to the alarm, and it is thought that the first stream was on the fire in about ten

minutes from the time that the lightning struck. The public department brought three steamers and, taking water from the hydrants, had their first stream on in about the same time. The outlets from the hydrants being but two and one-half inches, the supply for the steamers was scant, but they were enabled to put two effective streams on the fire.

The first man to look into the building saw the sprinklers working, and the superintendent also saw them in operation not later than fifteen minutes after the alarm. The sprinklers in this storehouse were on the dry pipe system, air being in the pipes at the time of fire. It is said that the electric alarm began to ring almost immediately after the lightning struck the building. It is probable that the fire flashed over the whole pile so quickly as to open nearly all the sprinklers at one time; and, but for the good pump pressure promptly applied, the supply of water would undoubtedly have been inadequate. The fireman should be commended for starting his pumps so promptly.

The fire extended down between the bales in some places to the floor, and could not be said to be well under control until some of the bales were broken down. As soon as the fire was well in hand, the work of removing the cotton from the storehouse was begun. The burned bales were distributed on the side hill north of storehouse No. 4, and the unburned bales placed on end between storehouses No. 4 and No. 5. It was roughly estimated that there may have been 2,000 bales more or less burned.

Summary: In considering the question as to how much benefit the sprinklers were in this fire, it should be noted, first, that the character of the fire was unusual, the lightning shattering the building to a considerable extent in the very beginning and undoubtedly starting fires at many points over the pile simultaneously; second, the construction of this storehouse was unusually light. Had it been more substantial, it is probable that under the same conditions the roof and sides would not have fallen so quickly and the sprinklers would have had more of an opportunity to do their work. As it was, as soon as one-half of the pile of cotton was covered with burning boards, the action of the sprinklers was much interfered with. On the other hand, one end of the building having been entirely consumed, it was comparatively easy to remove the burning bales of cotton promptly, which is very desirable in any cotton storehouse fire.

7923. March 19, 1906. At 10.40 a. m. a fire occurred in a one-story storehouse at this mill under the following circumstances:—

The building was one story in height with plank and timber roof, and frame sides covered with corrugated iron. At the time of the fire the building contained 1,134 bales of good middling cotton; also about sixty bales of colored cotton, card strips, etc., in a loose condition on the floor. The baled cotton was piled from one to four bales in height. A baling press was in use in the end next to the mill, the attendant being the only person in the building at the time fire occurred. He stated that after depositing an armful of stock in the press, he turned and found the pile

behind him ablaze. He immediately gave the alarm, which was responded to by the mill help, who brought a hose stream into the building from the yard hydrant. The public alarm was given a little later by an outside party, and two hose streams were brought in from the street hydrant. The water was shut off from the sprinkler equipment at the time fire occurred, as was the custom in many of the Southern mills in cold weather. As soon as the superintendent arrived, about ten minutes after the fire started, he ordered the water turned on, but in the meantime the fire had spread throughout four-fifths of the building and opened every sprinkler head. *The fire was extinguished after about forty minutes' duration.*

The cause of the fire was unknown, but was probably due to the press attendant stepping upon a match on the floor. Immediately after the fire, two hundred bales of the cotton were removed from the building and piled in the yard. In all, about four hundred bales of the white cotton and all of the miscellaneous stock mentioned was more or less burned.

Loss was adjusted at $5,900.

Summary: Water shut off on account of cold weather.

Lesson. This fire illustrates the necessity of having the sprinkler equipment automatic. This can be done either by providing sufficient heat so that a wet system can be maintained, or by providing an air valve. The fire also illustrates the necessity of not using storehouses for other purposes than storing cotton.

9280. November 26, 1909. A description of this fire was given in the April, 1910, QUARTERLY, Volume 3, Number 4, page 495.

A large loss resulted from obstruction to distribution, due to piling cotton bales too high.

10361. June 5, 1910. A description of this fire was given in the January, 1911, QUARTERLY, Volume 4, Number 3, page 365.

Work of sprinklers was not satisfactory, due to slow action of badly overloaded dry valve, and owing to deep piling of loosely packed bales.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control was satisfactory.)

344. March 27, 1899. This was a standard warehouse with several compartments. Brick side walls, wooden ends, open joist roof, plank floor. There were 104 Grinnell glass disc sprinklers in room, with static pressure of twenty-five pounds from tank. Fire broke out in No. 2 compartment at about 6 p. m., and was immediately discovered by yard boss. Twenty-seven sprinklers opened and did excellent service in holding fire in check and keeping fire from breaking into a blaze. Steam pump was started at once and maintained an increased pressure on sprinkler system.

Value of building, $4,000; no loss. Value of contents $100,000; loss about $14,000. This was a typical cotton bale fire.

3655. October 23, 1904. Fire started in cotton on an open platform and spread to the joisted wooden warehouse. Supposed to have been caused by a small boy who was seen striking a match on a cotton

tie. Owing to the lack of sprinkler protection, the fire on the platform was hard to conquer and it ate into the bales. Owing to the shortage of water, it was necessary to carry the bales about half a mile to a creek, where they were opened and the inside fire extinguished. There were forty-eight sprinklers in the warehouse room, supplied by gravity tank, which gave a pressure of about fifteen pounds. Pressure was increased by use of pump. The sprinklers successfully controlled the fire inside of the warehouse. There was a loss of $1,200 to the building, however, and a loss of $7,595 on contents. Fire was due to mischievous use of matches.

7691. July 1, 1908. At 4 p. m. fire occurred on the second floor of Compartment No. 8 in cotton warehouse. The second story contained 1,056 bales of selected middling cotton, uncompressed, piled several bales deep. The first story contained 359 bales of various kinds of waste stored one bale deep on end. The fire apparently started about thirty feet from the front of the building, between the first and second bales of cotton from the bottom, and extended over sixty-two bales. The fire was discovered by one of the employees in No. 2 mill, who noticed smoke and reported it to the office. The mill alarm was at once given and apparatus and pump quickly brought into use. A part of the front wall was removed and hose streams used. Later a part of the rear wall was also removed and a hole cut through the roof and a hose stream applied there. Six sprinklers located over the fire opened promptly and controlled it. The static pressure on heads that operated was thirty-seven pounds from gravity tank. The burned bales were removed to the platform and the fire was extinguished in them by the use of buckets of water. The water from the sprinklers and hose streams ran through the floor and upon the waste stored below. The fire was extinguished after a duration of about forty-five minutes.

Loss reported as $5,000 to $8,000.

8426. December 23, 1908. Warehouse was standard mill construction. Cotton was piled from floor to within eighteen inches of the sprinkler piping. Equipment was dry system, Grinnell differential dry valve, with 240 heads on the system. Sprinklers were installed in standard manner. Air pressure on system, thirty-five pounds, and static pressure on sprinklers which operated forty pounds from a 75,000-gallon gravity tank.

Fire started at 9.30 p. m., while plant was not in operation. It was discovered by employees at nearby store, who heard the sprinkler alarm. Four hose streams from private system were laid, and fifty-nine sprinklers opened. There were sixty in the room. Steam pump was used to reinforce the pressure and aided in extinguishing the fire. Sprinklers were in operation two and one-half hours, and held fire in check. This was a typical cotton bale fire.

Loss about $8,000.

10949. November 16, 1910. Fire occurred in second story of cotton storehouse, Section D. This was a two-story, brick building of mill construction, and was sprinklered in standard manner. The second story contained 491 bales of strict middling cotton, which had recently been purchased locally, and the work of filling this compartment had just been completed. The cotton was piled five bales high on the sides, except in the east end, where it was piled three bales high. The first story was practically vacant, containing but thirteen bales of waste cotton and bagging.

The watch clock records showed that the night watchman was at the station on the outside of Compartment D at about 5.30 on the morning of the fire. He saw nothing at this time to indicate that there was any fire in the building. At about 6.30 the yard foreman smelled smoke and, upon investigation, discovered the fire. He gave the alarm, and two hose streams were brought into use through the door at the west end of the building. Twenty-nine sprinklers had operated and were holding fire in check. The static pressure on sprinklers was forty pounds from gravity tank. A little later a third stream was used through the door at the east end of the building. The fire worked its way through the entire pile except in the northeast corner. This was a typical cotton bale fire.

Loss was $12,000 to $14,000.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Adverse Conditions.

H-4935. The fact that the fire had made extensive headway before the firemen were summoned, that the building on account of the river was inaccessible on two sides, and that a strong wind from the southwest fanned the flames, precluded any possibility of saving the building. There was no automatic inside protection.

Alarm Service.

S-8548. Dry pipe system. The small loss resulting from this fire was apparently due to the prompt alarm given by the satisfactory operation of the alarm connection. The sprinklers held fire in check, but the prompt use of hose streams saved a large loss.

H-4767. Boss carder in No. 2 mill, in looking across to storehouse, saw fire through a window in the third story. He immediately gave an alarm from an automatic fire alarm box located in the stair tower of mill. Receiving no response, a second alarm was rung in with like results.

Alarm systems should receive good care and attention.

S-8045. The point of interest brought out by this fire was the need of an efficient alarm. It was evident that the fire must have been burning, for a long time, as it had spread from the bale in which it originated to seven adjoining bales, and had burned a small hole completely through

the floor before finally extinguished or controlled by the sprinklers. The first knowledge the watchman had of the presence of fire was from the water running out of the bottom of the door on the first story at the opposite end of compartment. No watchman's stations at warehouse.

Automatic Sprinklers.

Dry Pipe Systems.

S-8545. This fire was noticeable as illustrating the good protection afforded by dry pipe systems when they are in order.

S-10851. Building was equipped with a five-inch 1892 Manufacturers' dry valve, with 106 heads on the system. The air pressure was 40 pounds and static pressure on sprinklers 85 pounds from automatic steam pump. Sprinklers were installed in standard manner. Valve operated promptly and fire was extinguished by the operation of four sprinklers.

S-8093. There were 234 heads on dry system, controlled by an old type Grinnell differential dry valve. Air pressure was 30 pounds and static pressure on sprinklers was 34 pounds. Dry valve operated satisfactorily and fire was extinguished by the operation of two sprinklers.

Unsatisfactory Action of Dry Valve.

S-10361. An old Grinnell differential dry valve had 500 heads on system. There were four long four-inch and one six-inch branches. Fire burned almost through two-inch plank of roof over the corner where fire started. There was probably a delay of five minutes. Static pressure on sprinklers was 45 pounds and air pressure was 25 to 30 pounds.

High Pressure.

S-10851. An interesting feature of this fire was the manner in which less than four per cent of the sprinklers in this, a non-fireproof, building stored with cotton, confined the fire damage to less than three per cent of the total contents. This risk was equipped with a dry pipe system. There were 106 heads, installed in standard manner, which had a static pressure of 85 pounds, supplied by automatic steam pump.

Poor Equipment.

F-5699. Fire burned ceiling so that hangers supporting sprinkler pipes loosened and dropped pipe, which broke and put four lines of six heads each out of commission.

Water Shut Off too Soon.

S-4441. When the doors were opened, the water was issuing from the sprinklers, and the building was full of smoke. After some time, two local streams having been used, it was thought the fire was out, and the water was shut off the system and some of the help went away; but on moving the bales, fire flashed out. Whistle was blown and the water again turned on the sprinklers.

Construction.

Fire Walls.

S-3454. The brick fire walls at each end of this compartment were practically uninjured and no damage whatever occurred in compartments on either side of that where fire occurred. The latter sustained a heavy loss, both on building and contents.

H-4741. Warehouse was 163 by 60 feet, divided in the middle by a blank brick parapeted fire wall. Walls were wood, tin-clad, and roof open joist construction. The easterly compartment was destroyed by fire, but the fire wall held perfectly and no damage was sustained in the westerly compartment.

S-8919. South section of a two-compartment warehouse was burned out. Brick division wall had a large opening provided with a standard tin-clad fire door. This was shut at time of fire and no damage resulted in north section.

Heavy Timbers.

S-3454. It was interesting to note that posts eight by eight inches on the two lower floors and six by six on the top floor, although many were badly burned, were all in place, and especially that the six by six on top floor, although half burned off, had sufficient strength remaining to prevent the roof from falling on the cotton.

H-4741. Tin-clad construction. All the walls were wood, tin-clad. This offered the usual difficulties to the firemen in cutting their way into the building.

H-5088. Unprotected skylights. There had been a fire in an adjacent compartment, which had been practically extinguished several hours before fire was discovered in this compartment. It was thought that there had been a hole or two in one of the large, thick glass, unprotected skylights in roof, through which hot embers may have passed.

Cotton Storage.

S-8383. Four hundred bales of cotton were stored one high on end. Action of sprinklers and dry system eminently satisfactory. Only two heads opened in room containing 132, and extinguished fire with a loss of $50. Value of contents $16,500.

S-10361. This was a dry system. Dry valve worked properly, except that it was evidently a little slow. A large loss was sustained. Probably a bad loss would have resulted had this been a wet system, owing to deep piling of loosely packed bales.

S-6461. Cotton was piled flat-wise, six bales high. Twenty-six sprinklers opened and held fire within small limits, but the water was not very effective near the bottom of the pile.

S-4441. Cotton was piled seven bales high. There were 1,140 bales in room and 334 were involved in the fire. The sprinklers could not reach the fire low down in the pile, although 33 heads opened.

S-8672. The sprinklers practically put out the fire but could not play between the bales, where the fire found a lodging place.

There were about 1,500 bales of cotton in the storeroom, tiered three to seven bales, high, but a lot of 170 bales was the only cotton affected by the fire. Sixteen heads operated, forming a water curtain about the fire and preventing same from spreading. The burning cotton adjoined other tiers on two sides, but on the other two sides was separated from the nearest cotton by five-foot aisles.

S-8942. The cotton was piled six and seven bales high, with a passageway about three feet wide running through the center. There were about three hundred bales involved. As soon as possible employees were set to work pulling out the burned bales, of which there were about fifty, and the rest were more or less wet.

It was stated that the sprinklers were operating before the first hose stream was put on, and they apparently did good service, but it is doubtful if they could have extinguished the fire on account of the manner in which cotton was piled.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	6	14	2	6	..	8	9	1	8	9
2	8	18	..	..	..	8	9	2 or less	16	18
3	8	18	1	3	..	9	10	3 or less	25	28
4	5	11	3	9	..	8	9	4 or less	33	37
5	1	2	4	11	..	5	6	5 or less	38	42
6 to 9 inc.	3	7	6	17	..	9	10	Less than 10	47	52
10 to 24 inc.	6	14	7	20	..	13	14	Less than 25	60	67
25 to 49 inc.	7	16	10	28	4	21	23	Less than 50	81	90
50 and over	..	..	2	6	7	9	10	50 and over	9	10
Total	44		35		11	90				

Average number of sprinklers opened, not including unsatisfactory, 13.5.

12. ALARM SERVICE.

Fires satisfactorily discovered by one agency alone. Failures not included.

Watchman.	Sprinkler Alarm	Thermostat.	Employee or Outsider.	Total.
27	16	1	51	95

Efficiency of Alarm Service Where More than one Agency was Used.

	Watchman.		Sprinkler Alarm.		Thermostat.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Employee or Outsider Gave Alarm.
Watchman and sprinkler alarm	3	2	5	..	..	..	..	5
Watchman and thermostats	1	..	..	..	1	..	..	1
Sprinkler alarm and employee or outsider	..	..	4	3	..	..	7	7
Watchman, sprinkler alarm and employee or outsider	..	1	..	1	..	..	1	1
Watchman and employee or outsider	1	6	..	..	..	..	7	7
Total	5	9	9	4	1		15	21

13. SECONDARY WATER SUPPLIES.

Summary.

There were 22 fires, or 26 per cent, in which the secondary supply was a factor in the extinguishment. Of these fires 36 per cent were practically extinguished, 45 per cent were held in check and 19 per cent resulted in failure. Sixty-four per cent of these fires were extinguished with a small loss, and in 36 per cent a large loss resulted. Six of the large losses were sustained in the failure fires. In twelve of these fires the private yard protection was used, including the four failures. The average pressure of the primary supply was 35 pounds. Average pressure of the secondary supply about eighty pounds.

Details.

S-344. Primary water supply was a gravity tank giving 25 pounds pressure on the first of 27 sprinklers which operated. Steam pump was used. Sprinklers held fire in check.

S-759. Primary supply was a gravity tank, giving 20 pounds pressure on the first of nine sprinklers which operated. Steam pump used. Sprinklers held fire in check.

S-2207. Primary supply was waterworks, giving 40 pounds pressure on the first of eight sprinklers which operated. Steam pump maintained 75 pounds pressure on the system. Sprinklers held fire in check.

S-3332. Primary supply was gravity tank, giving 48 pounds pressure on the first of seven sprinklers which operated. Steam pump maintained 70 pounds pressure on the system. Sprinklers held fire in check.

S-3655. Primary supply was gravity tank, giving 15 pounds pressure on the first of 48 sprinklers which operated. Steam pump used. Sprinklers practically extinguished fire.

S-4192. Primary supply was private reservoir, giving 40 pounds pressure on the first of four sprinklers which operated. Steam pump was used. Sprinklers practically extinguished the fire.

S-4563. Primary supply was gravity tank, which was shut off at time fire started. Steam pump was maintained at 50 pounds pressure on the 33 sprinklers that operated. Sprinklers held fire in check. Large number of heads opened, due probably to the fact that water was shut off at first.

S-5300. Primary supply was gravity tank, giving 30 pounds pressure on the first of 35 sprinklers which operated. Steam pump maintained 100 pounds pressure for twenty minutes. Sprinklers practically extinguished fire.

S-5487. Primary supply was gravity tank, giving 20 pounds pressure on the first of 54 sprinklers which operated. Steam pump was used. All the heads in room opened, and failed to hold the fire in check. Fire was extinguished by private outside protection.

S-5654. Primary supply was gravity tank, giving 15 pounds pressure on the first of three sprinklers which operated. Steam pump maintained 100 pounds pressure on the system for one hour. Sprinklers practically extinguished the fire.

S-5665. Primary supply was pressure tank, giving 90 pounds pressure on the first of 32 sprinklers which operated. Steam pump was used. Sprinklers held fire in check.

S-6019. Primary supply was gravity tank, giving 40 pounds pressure on the first of 19 heads which operated. Another gravity tank of larger capacity maintained a pressure of 30 pounds on the system. Sprinklers held fire in check.

S-6054. Primary supply was gravity tank, giving 66 pounds pressure on the first of 35 sprinklers which operated. Steam pump was used for one hour. Sprinklers failed to hold fire in check. Fire was extinguished by private and public outside protection.

S-6077. Primary supply was gravity tank, giving 52 pounds pressure on the first of 32 sprinklers which operated. Steam pump was used for fifteen minutes and supplied one half of the water. Sprinklers practically extinguished fire.

S-6313. Primary supply was gravity tank, giving 35 pounds pressure on the first of 48 sprinklers which operated. Steam pump maintained 100 pounds pressure on the system for one hour. Sprinklers held fire in check.

S-6549. Primary supply was waterworks, giving 18 pounds pressure on the first of 90 sprinklers which operated. Rotary pump was used for twenty minutes, and furnished one half the water. Sprinklers failed to hold the fire in check. Fire was extinguished by private and public outside protection.

S-7918. Primary supply was waterworks. Steam pump was used. All the sprinklers opened, and failed to hold fire in check. Private and public outside protection used, but a heavy loss resulted.

S-8092. Primary supply was waterworks, giving 35 pounds pressure on the first of 36 sprinklers which operated. Steam pump maintained 40 to 50 pounds pressure on the system, and furnished about 50,000 gallons of water. Sprinklers held fire in check.

S-8426. Primary supply was gravity tank, giving 40 pounds pressure on the first of 59 sprinklers which operated. Steam pump was used for two and a half hours. Sprinklers held fire in check.

S-11340. Primary supply was gravity tank, giving 40 pounds pressure on the first of 30 sprinklers which operated. Steam pump maintained 100 pounds pressure for thirty minutes. Sprinklers practically extinguished fire.

S-11398. Primary supply was gravity tank, giving 15 pounds pressure on the first of 36 sprinklers which operated. Steam pump was used for twenty minutes. Sprinklers practically extinguished the fire.

S-11539. Primary supply was gravity tank, giving 23 pounds pressure on the first of 16 sprinklers which operated. Steam pump maintained a pressure of 60 pounds on system for forty-five minutes. Sprinklers practically extinguished the fire.

14. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	29	34	58	7.4	20	10.6	3.5	58	61	42	6.2	11.1
Gravity tank,	51	60	36	14.5	28	27	4.5	35	35	47	12.2	19.6
Pressure tank,	1	1	90	32.	..	1.2	..	..	90	..	..	32
Automatic pump,	4	5	81	11.	4	1.2	..	82	78	..	9.3	16
Total,	85	100	46	12.2	52	40	8	47	45	44		17.6

15. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	1	1	10	5	..	1.2	..	..	10	..	..	5
15 to 24 inclusive,	11	13	20	17.6	8	2.3	2.3	18	28	19	20.4	25.5
25 to 49 inclusive,	39	46	36	14.1	23	22.5	1.2	38	33	45	6.7	22.3
50 and over,	34	40	68	8.4	21	14	4.5	69	69	57	9.3	9.9
Total,	85	100	46	12.2	52	40	8	47	45	44	9.9	17.6

16. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	45	53	41	11.4	23.5	24.5	4.5	42	37	57	8.1	16.8
Dry system,	40	47	52	13	28.5	15.5	3.5	52	58	28	11.4	18.9
Total,	85	100	46	12.2	52	40	8	47	45	44	9.9	17.6

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	29	34	58	7.4	6	22	6	73	58	43	2	8.3	24
Gravity tank,	51	60	36	14.5	4	40	16	62	33	35	4	13	28.8
Pressure tank,	1	1	90	32	..	1.5	..	..	90	..	..	32	..
Automatic pump,	4	5	81	11	1	3.5	..	85	79	..	4	13.3	..
Total,	85	100	46	12.2	11	67	22	71	45	37	2.9	11.8	28

18. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	1	1	10	5	..	1.5	..	..	10	..	..	5	..
15 to 24 inclusive,	11	13	20	17.6	..	9	3.5	..	19	23	..	15.8	34
25 to 49 inclusive,	39	46	36	14.1	1.5	33	12	45	35	35	1	10.4	28.4
50 and over,	34	40	68	8.4	9.5	23.5	6.5	74	71	47	3.1	12.5	12
Total,	85	100	46	12.2	11	67	22	71	45	37	2.9	11.8	28

19. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	45	53	41	11.4	5	33	15	62	38	40	1.5	10.5	23.7
Dry system,	40	47	52	13	6	34	7	77	52	32	4	13	41
Total,	85	100	46	12.2	11	67	22	71	45	37	2.9	11.8	28

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

Interesting Cotton Warehouse Fires.

February 28, 1908.

S-6973. Description of Building. Brick, 70 feet by 240 feet; one story (average 22 feet) in height; roof open joisted construction, with wooden uprights; no openings in walls except three doorways at front end, provided with 2-inch wooden, sliding doors with tin nailed to outside only; floor of boards laid on ground or on sleepers. Full capacity, 2,000 bales; actual contents, 1,688 bales of American cotton piled in lots from 1 to 200 bales or more, laid flat and tiered 6 to 10 bales high; practically none skidded.

Protection.

Standard dry pipe system of automatic sprinklers, embracing 288 Manufacturers' heads, installed 1905, supplied by two Underwriter steam pumps, each of 1,000 gallons capacity; one automatic, draughting from city main and supplying 85 pounds pressure in sprinkler and hydrant system, the other non-automatic and draughting salt water from New York Bay; also a 100,000-gallon gravity tank giving 60 pounds pressure at ground level.

System maintained dry pipe all the year round under air pressure of 40 pounds obtained from an automatic electrically driven air pump. Under practically constant test, all valves being electrically connected with an alarm system, so that interruption of, or interference with, any part of the equipment gives immediate alarm; outside hydrants, hose, patrol, etc.

Fire.

Fire occurred at 12.10 p. m. in Compartment No. 19. It was discovered by the sounding of the automatic alarm in the pump house, showing that sprinklers had opened and that dry valve controlling these had operated. Private fire alarm was sounded by means of whistle and public alarm was turned in at box. As it was the noon hour no one was in the vicinity of store; however, on reaching there the bell on the building was heard ringing.

The hose cart adjoining Store No. 14 was run out and one length of hose stretched from nearest yard hydrant. Water was played from this source on the fire for about thirty seconds before the fire department arrived. On the arrival of the fire department they found considerable smoke in building and a little flame. They at once entered the store, ran out one length of hose from the same yard hydrant and removed the four skylights in roof to let out smoke. The water from the sprinklers was turned off from the outside by the post indicator gate valve.

The fire was found practically out, but one hose stream was kept in use for about two minutes by the fire department to put out smouldering patches on bales as they were pulled down and removed from building.

Operation of Sprinklers and Results.

Four heads operated directly over or in the vicinity of the lot of cotton in which fire occurred and were in service about ten minutes. The burning lot covered about sixty-four square feet near center of store and contained fifteen bales piled five and six high and reaching to within about six feet of the sprinkler pipes, with a one-foot space on one side, three feet on another, eight feet on another and an eight to ten-foot aisle between it and the lot piled opposite. Fire was confined to the lot of bales in which it started. The floor under cotton was burned and scorched a little, but the action of the sprinklers was so efficient that the fire did not burn into the wood to any depth. Indications are that the fire started near or at the floor and in the interior of the pile. There was very little, if any, burrowing in any bale, the fire doing most damage on the outside. The bales were burned and scorched on the exposed sides only, especially on the side nearest the floors. The burlap coverings were in most cases badly damaged. One sprinkler head was knocked off by firemen in removing skylight.

Cause of Fire and Loss.

Cause not ascertained. No stock had been received or taken out on the morning of the fire. The cotton that burned was in one, three, four and five bale lots, and had been in warehouse for several months. At time of fire the warehouse was locked up and the doors were kept closed, which cut off the fresh air and undoubtedly aided the sprinklers in smouldering the flames, preventing them from spreading to neighboring piles as well as considerably reducing the number of sprinkler heads necessarily opened.

Loss on building was slight. Loss on contents less than one thousand dollars.

June 13, 1906.

S-4896. Location and Conditions. In this fire, which occurred in Compartment 22, a lot of baled cotton, covering a floor area of about six hundred square feet and tiered six and seven bales high, was practically extinguished by means of automatic sprinklers with but slight loss to the cotton and none to the building, except that which was produced by the firemen.

At time of fire this warehouse contained 2,744 bales of American cotton in lots of from 79 bales to 200 or more, laid flat, and tiered 6 to 10 bales high. None was skidded to any extent.

The lot in which fire occurred contained 79 bales, and was located at the left and near the doorway, there being about 4-foot space to wall. There was a 10-foot aisle between this lot of cotton and the lot opposite or on the other side of the warehouse, and about a 22-foot space to the next lot on the same side. The bales were tiered to within four feet of the sprinkler pipes.

These lots were well separated, having good aisle space down the center of the warehouse and between the different lots. There was, however, no space of note between the bales and side walls, except in the case of the lot in which the fire occurred.

Discovery of Fire and Alarm. Two carpenters were at work in the warehouse repairing a break in floor about twenty feet from the cotton in which the fire occurred. They claim to have scented smoke and felt heat coming from the cotton piled in the left hand corner of the warehouse and near the doorway, and without stopping for anything they dashed out into the alley and gave the alarm. The foreman of the cotton department, who happened to be in the vicinity, promptly closed the iron doors to the warehouse, thus stopping all draught. The giving of alarm by these men was almost immediately followed by the operation of the electric alarm bell and annunciator in the pump house, and the sudden starting up of the automatic steam pump showed that the automatic sprinklers and the dry valve controlling same had operated. The private fire alarm was sounded by blowing the whistle, and an alarm was also sent in from the public fire alarm box.

Operation of Sprinkler Equipment. Twenty-two sprinklers out of 213 operated, those that operated being directly over or in the immediate vicinity of the cotton in which the fire occurred. These were in service about fifteen minutes and practically extinguished the fire.

The sprinklers were supplied by two steam pumps, at a pressure of 100 pounds. Two hose streams were also supplied by these pumps at intervals during the fire. One pump was in operation about twenty minutes, the other about ten minutes, and at no time were they called upon to discharge their rated capacity. The tank supply was not drawn on.

So perfect was the work of the sprinklers in spreading a blanket of water over the heated area that it was impossible for the fire to flash to the next nearest lot of cotton, resulting in the fire being confined to the lot in which it originated. That there was considerable heat given off by the burning cotton was evident by the fact that sprinklers over twenty feet distant operated, yet the roof boards were scorched in but one place. The roof support was not even scorched.

Lesson. It is of interest to note that the lot in which the fire occurred was the first from the entrance to the warehouse and that it had a space about it on all sides, except near the doorway where it was piled in contact with small wooden offices used by cotton inspectors. It was also piled against one of the roof supports that extend from floor to roof. The fact that there was thus a space on practically all sides of the pile materially aided the prompt extinguishment of the fire by the sprinklers.

The successful extinguishment of these fires should not be taken as conclusive that the general practice of the high piling of cotton bales is a good one.

Electric Light and Power Stations

A study of the statistics in the Fire Record of Electric Light and Power Stations shows some very interesting points in connection with this class of plants. The fires which originated from common causes outnumbered the special hazard fires nearly two to one. Boiler and lightning fires are the most prominent causes. In connection with the boiler fires, the fact that one-third of these originated because of the iron stack being improperly protected renders our article on this subject of special interest. In the special hazard fires, electric wiring, either defective or by reason of crossed circuits, was productive of the greatest trouble. The preponderance of common causes over special hazard fires would seem to show the effectiveness of the present practice in safeguarding electrical hazards. It was hard to distinguish from our reports, as rendered, the proportion of fires originating in, or caused by, high tension equipment from those in the comparatively low voltage apparatus of 500 volts and less.

Our records show that only two fires occurred in plants of fire-resistive construction. A little over one-third of the buildings were brick and wood construction. From the reports as given, it would seem essential to establish fire divisions between a boiler and generator room, especially in plants of compound occupancy as, for instance, light and waterworks pumping stations. The pumping apparatus should be well cut off from the rest.

Very few plants were provided with private outside protection or with inside protection. A number of the plants reported no inside protection whatever. Water or sand pails seemed to predominate, but chemical extinguishers, where used, were always reported as being very satisfactory. Nearly half the fires were extinguished by the help of the public departments.

Over three-fourths of the plants were devoted to the production of light or power. A study of the losses would seem to indicate that a power house was subject either to a total loss or to comparatively slight damage. The largest percentage of losses on contents alone were heavy losses. Twenty-five per cent of the fires occurred in or around boiler rooms, and nearly twenty-five per cent more were divided between generator rooms and transformer houses or rooms. As might be expected, two-thirds of the fires occurred at night, and the greatest percentage while plants were in operation. This would account also for the large number of fires which were discovered by employees. In connection with the watchman service, there were reported three failures.

Conclusions.

Electrical machinery operating in multiple and having rapidly revolving parts carrying heavy copper conductors should be so equipped and controlled that a short circuit within a machine will automatically stop generation in the defective machine and disconnect from the system.

High voltage conductors and apparatus should be protected from possible flying particles of metal, preferably by enclosures of non-combustible material.

Switchboards should be so located or guarded that operators may manipulate controlling devices in safety.

Quick acting valves controlling turbines should be so located in all hydro-electric plants that water may be promptly cut off by closing valves at a convenient point outside the generator room.

Ventilators or other roof structures of frame construction are a menace even on unexposed generating stations.

Power houses having roofs composed of combustible material are always liable to serious damage, especially where remote from fire protection; but where a wood roof is unavoidable, the heavy mill type is least objectionable.

Roof coverings having good fire-retardant qualities are absolutely essential to the safety of power houses.

Frame air chambers for cooling transformers, and similar construction work creating concealed spaces which may conceal the presence of fire, constitute an unnecessary fire danger.

Combustible supplies, especially waste, whether clean or oily, should be kept in covered enclosures or tanks constructed of non-combustible material.

Standpipe and hose equipment with ample water supply and pressure to produce effective fire streams are indispensable to the safety of power houses having combustible roofs or floors or containing combustible materials in quantities. This is particularly true of stations remote from public protection.

Ladders, fire axes, pike poles and crowbars should be provided for all power houses having roofs, roof structures or other construction work of combustible material. These appliances facilitate prompt access to all parts of the building and expedite the removal of all combustible construction work which may conceal fire, or otherwise impede the work of extinguishing it.

Electrical generators and motors of comparatively low voltage rating are more liable to damage by heat than by water where small fires are concerned.

Cool determined, resourceful leadership, coupled with good judgment, is the most important factor in the saving of property in time of fire.

The transformer station fires are of considerable interest. Owing to the large quantity of oil, transformers have been thought to offer a considerable fire hazard. Unless proper precautions are taken, this is true.

Transformer oil itself will not take fire unless raised to a temperature of approximately 400° F., and unless supply has ample oxygen. The only other danger is said to be from the oil vapor that is given off from hot oil, which when mixed with a proper proportion of air gives a highly explosive mixture. This may develop a pressure of 100 pounds per square inch. It is very easily ignited by a spark. It is difficult to build transformer tanks absolutely oil-tight, and as oil exposed to the air burns readily, it would not seem advisable to dry out transformer oil by fire under the transformer, unless there were only the oil of the transformer to be endangered. This is sometimes taken out of doors where the fire risk to other apparatus is eliminated. As it is practically impossible to ignite oil from the inside, even by arcs of considerable power, the only danger of transformer oils comes from an arc very near the surface of the oil, or from an outside source altogether. In a fireproof building, the one thing that would ignite oil would be to build a fire under the transformers. An interesting fire is recorded under Section 10, caused by the ignition of escaping oil from a transformer which was being heated by a charcoal fire. A close watch should be kept for such fires at all times. When such a risk is to be taken, a good supply of sand should be close at hand to be used in case a small fire should start. As water only spreads the oil and exposes it to more air, it is more of a hindrance than a help. Chemical extinguishers prove very satisfactory in fires of this nature, but sand is even more effective. If local conditions are such that a steam jet can be used advantageously, this is very effective in extinguishing fire if the space is not too large and the steam can be confined. If considerable oil is used, a quick method of draining the oil should always be provided. Good authority states that large insulated transformers should always be built of boiler plate, which will not easily melt and allow the oil to flow out, and should be provided with some form of safety valve which will relieve any pressure that may develop and yet not expose the oil to any amount of air. Oil vapor ignites with ease, and for this reason, open flames should not be allowed in the vicinity of hot oil. It should be the practice to dry transformer oil either by immersing heating coils in the oil or by employing a dehydrating agent, such as lime, or by blowing air through warm oil. When heating coils are used, the heat is applied below the oil surface, where it is impossible for ignition to take place.

The following specifications have been suggested for a fireproof high-voltage sub-station: Building to be of fire-resistive construction; incoming circuits dead-ended on suspension insulators, with disconnecting knife switches and taps which provide for the by-passing of the sub-station; lightning arresters in separate wing of fireproof construction; oil switches to be mounted in separate structure containing no inflammable material; rolling steel doorways with padlocks for all independent structures carrying high-potential wiring; wired-glass windows and skylights; all interior lower-tension wiring in conduit, with remote control of oil switches for incoming and outgoing services; marble or slate busbar compartments with approved insulating barriers; carriage, track and winch for removing transformers; and the allowance of extraordinary space for the clearance of all high-voltage leads.

Electric Light and Power Stations—Fire Record.

Total number of fires, 95.

1. CLASSIFICATION OF CAUSES.

Summary.

Common Causes.

	No. of Fires.	Per Cent of Common.	Per Cent of Whole.
Lighting	2	4	
Power	6	12.5	
Boiler (or fuel)	18	37.5	
Spontaneous Combustion	5	10.5	
Smoking	2	4	
Lightning	11	23	
Sparks	2	4	
Miscellaneous	2	4	
Total	48		50.5

Special Hazard Causes.

	No. of Fires.	Per cent of Special.	Per Cent of Whole.
Electric Wiring	8	28.5	
Generator	5	18	
Transformer	4	14.5	
Unknown, Electrical	3	10.5	
Miscellaneous	8	28.5	
Total	28		29.5
Incendiary	1		1.1
Exposure	4		4.2
Cause Unknown Fires	14		14.7
Total	95		

Details.

Common Causes.

LIGHTING. Number of fires, 2.

Employee ignited oil-soaked walls in cellar with torch.

Defective electric light wiring.

POWER. Number of fires, 6.

Fuel oil supply pipe came apart at union and flooded room with oil under pressure. Oil was ignited by fire under boilers.

Overheated friction clutch.

Spark from hot journal dropped into pan of oil.

Slipping of wooden gear on water wheel shaft.

Explosion of torch used for heating vaporizer on oil engine.

Can of gasolene near gasolene engine became ignited.

BOILER (or fuel). Number of fires, 18.

Iron stack too near woodwork, overheated or improperly protected, 6.

Heat from boilers ignited roof 4.

Ashes exposed to woodwork, 2.

Sparks from chimney fell on roof.

Sparks from boiler entered shavings vault.

Heat from boiler ignited soot which had collected on top of boiler and between it and wall.

Gas used as fuel. Turned on too high and left by watchman.

Ignition of soft coal piled up against wood boxing on outside of boiler house wall.

Blow-off cock gave way, throwing steam into fire box and sending fire out over entire building. Boiler was being fired with shavings from a planing mill.

SPONTANEOUS COMBUSTION. Number of fires, 5.

Soft coal, 2.

Oily material, 2.

In coke pile.

SMOKING. Number of fires, 2.

Match or cigar stub carelessly thrown on floor in closet.

Employee entered office smoking. Probably dropped a match or hot ashes.

LIGHTNING. Number of fires, 11.

Transformer house, 3.

Entered building on high tension wires, 2.

Wire tower of engine room.

Engine room.

Storage battery house.

Office building.

No details, 2.

SPARKS. Number of fires, 2.
From stack.
Passing locomotive.

MISCELLANEOUS. Number of fires, 2.
Oil leaked from a barrel, ran across steam pipes, and became ignited.
Caused by thawing out drip pipe with waste and oil.

Special Hazard Causes.

ELECTRIC WIRING. Number of fires, 8.
High tension wires became crossed or short circuited, 3.
Insulation burned off cable which entered building.
Telephone wire crossed with alternating current conductor.
Defective wiring about dynamo.
Feed wires outside of building.
Feed wires inside of building.

GENERATOR. Number of fires, 5.
Short circuit in generator due to grounding caused a terrific report.
Man upset can of oil, and oil was ignited by sparking.
Large railway generator short circuited in armature, arced to frame of machine and ignited oily plank floor.
Insulation broke down at the bearing end of commutator.
Short circuit in generator.
Occurred in generator.

TRANSFORMER. Number of fires, 4.
Short circuit in oil transformer, exploded soon thereafter.
Short circuit in transformer room.
Oil escaping from transformer became ignited from a charcoal fire used to heat the transformer.
No details.

UNKNOWN ELECTRICAL. Number of fires, 3.
No details given.

MISCELLANEOUS. Number of fires, 8.
Employee left fire in portable forge, and in some way forge was upset.
Short circuit in circuit breaker.
Arc set fire to oil drippings from engine.
Breaker caused short circuit, which ignited oily flooring.
Defective fuse on switchboard.
A defect in equalizing apparatus set fire to the insulation on the network of cables.
Overheated oil switch.
Defective meter.

Exposure.

Number of fires, 4.
Sparks from burning sawmill nearby landed on roof.
Burning coal pocket, 100 feet distant, damaged wired glass windows.

Heat from fire in carriage repository nearby damaged wired glass windows.

Fire in nearby building communicated to plant.

Special Details.

H-1445. Fire was caused by a wooden gear on the water wheel shaft slipping and coming in contact with the bridge-tree, which was ignited by friction.

This fire was another illustration of how a fire may start in a "damp or wet" place, and is a reminder that in equipping plants with automatic sprinklers, such locations should be carefully sprinklered.

H-1270. Explosion of kerosene oil torch used for heating vaporizer of a Hornsby Ackroyd 125 horse power oil engine. Vaporizer had been in process of heating for some time, when a fresh torch was placed under same and engine started. The torch exploded, throwing oil in all directions and onto belt connecting engine with dynamos, which quickly spread fire to all parts of the building.

H-1447. It had been thoroughly well established that the power plant was only about half the capacity that it should have been to meet the increased traffic which the line had recently employed. Fire occurred on evening of Labor Day, when there had been an excessive travel on the line, and the machinery had been overtaxed during the entire day and evening. Fire originated in basement in an air-cooled transformer, which exploded. This ignited an oil-cooled transformer.

H-1381. While an attendant was in the act of filling an oil journal on main shaft of generator at the commutator end, a severe short circuit in armature, due to grounding of coil, caused a terrific report, which upset the man from his position at the bearing. He lost his balance, and spilled a can of oil, which was ignited from sparking brushes, etc. This communicated fire to open pit under fields of generator, burning insulation off the cables, fields, etc.

H-5156. Bolt of lightning passed lightning arrester, arresters on board, and circuit breaker. It punctured the center of armature core of a 500 K. W. railroad generator, and burned out twenty coils. No damage to building or other apparatus.

H-5456. Large railway generator "bucked" or short circuited in armature, arced to frame of machine, and ignited oily plank floor. This communicated to skylight.

Recommended: Cement floor around generator.

H-5246. A high wind caused wires carrying 60,000 volts and a tree across street to sway together. The wires were cross circuited. Tie wire was burned, which allowed the live wires to fall on roof of sub-station.

Suggestion: Keep all trees trimmed along line of poles, and also keep man in sub-station at all times, not depending on a regulator.

2. MISCELLANEOUS STATISTICS.

Nature of Occupancy.

	No. of Fires.	Per Cent.
Light	30	31.5
Light and Power	29	30.5
Power	23	24
Light and Water Works (Pumping Station)	6	6
Light and Gas	3	3
Light and Ice Manufacturing	2	2
Power and Machine Shop	1	1
Light, Power and Water Works	1	1
Total	95	

Loss on Building Alone.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
No loss	4	13	1	6	..	..	5	9
Slight loss	4	13	6	35	2	22	12	21.5
Moderate	3	10	3	18	1	11	7	12.5
Heavy	6	20	1	6	2	22	9	16
Total loss	13	43	6	35	4	44	23	41
Total with data given							56	
Not data given							39	
Total							95	

Loss on Contents Alone.

No loss	1	4	..	..	..	..	1	2
Slight loss	3	11	7	41	1	10	11	20.5
Moderate	2	7	2	12	2	20	6	11
Heavy	11	41	6	35	6	60	23	42.5
Total loss	10	37	2	12	1	10	13	24
Total with data given							54	
No data given							41	
Total							95	

Building and Contents. (Not specified above.)

Slight loss	3	21.5	1	20	1	17	5	20
Moderate	2	14	..	..	2	33	4	16
Heavy	5	36	1	20	..	..	6	24
Total loss	4	28.5	3	60	3	50	10	40
Total with data given							25	
No data given in any form							11	

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Boiler Room . . (Roofs, 4)	18	40	..	..	4	24	22	25.5
Generator Room . (Basement, 1)	3	7	7	29	1	6	11	12.8
Transformer House (Roof, 1)	6	14	4	17	..	..	10	11.6
Engine Room . .	3	7	5	21	1	6	9	10.4
Storage Room . .	1	2	1	4	4	24	6	7
Transformer Room (Basement, 1)	1	2	3	13	..	..	4	4.6
Roofs. Not otherwise enumerated	1	2	..	..	3	17	4	4.6
Basements. Not otherwise enumerated	1	2	1	4	..	..	2	2.3
Wheel House . . (Basement, 1)	2	4	..	..	..	..	2	2.3
At Windows . .	..	..	..	..	2	12	2	2.3
Coal Pile . . .	2	4	..	..	..	..	2	2.3
Engine and Generator Room . .	1	2	..	..	..	..	1	1.2
Boiler and Generator Room . .	..	..	..	..	1	6	1	1.2
Storage Battery House	1	2	.	..	..	..	1	1.2
Outside	..	..	1	4	..	..	1	1.2
Workshop . . .	1	2	..	..	..	..	1	1.2
Switchboard Room (In Basement)	..	..	1	4	..	..	1	1.2
Wire Tower . .	1	2	..	..	..	..	1	1.2
Coal Bin Hoist House . . .	..	..	..	..	1	6	1	1.2
Coal Room . . .	1	2	..	..	..	..	1	1.2
Clothes Closet . .	..	..	1	4	..	..	1	1.2
Shavings Vault .	1	2	..	..	..	..	1	1.2
Detached Office .	1	2	..	..	..	..	1	1.2
Total with data given							86	
No data							9	
Total							95	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	16	36	9	36	8	44	33	38
Night	28	64	16	64	10	56	54	62
Total with data given							87	
No data							8	
Total							95	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation	29	73	20	95	12	67	61	77
Plant not in operation	11	27	1	5	6	33	18	23
Total with data given							79	
No data							16	
Total							95	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	29	69	20	84	9	53	58	70
Watchman	5	12	2	8	2	12	9	11
Sprinkler Alarm	..	..	1	4	..	..	1	1
Outsider	8	19	1	4	6	35	15	18
Total with data given							83	
No data							12	
Total							95	

Number fires Watchman failed to discover, 3

7. POINTS OF INTEREST FROM FIRE REPORTS.

Exposure—Wired Glass Windows.

H-3961. This was a brick light and power station with windows protected by wired glass in metal frames, said to have been standard. The office of station was in a detached brick building with ordinary glass windows, except in one side which was a blank wall between the office and an adjacent exposing carriage repository. This was a large wooden building which was completely destroyed by fire. The end windows of office were burned out and considerable damage was done inside. The wired glass windows in power house showed the effects of great heat, and every window was badly cracked. Not a piece of glass fell out, however, and the windows did their duty admirably, undoubtedly saving a large loss in station.

H-2315. Fire occurred in coal pockets 100 feet north of brick power house. Heat was sufficient to crack many of the wired glass windows and the plate glass in the entrance door. The wired glass in the skylights was not damaged. There was no damage inside of station.

H-2668. The building was light framing and iron-clad, roof sheathed and covered with composition. There was practically nothing in building to make a hot fire, but machinery was mostly ruined. A planing mill twenty-four feet away and an ice plant twenty-five feet away were not damaged. The conclusions were that an iron-clad building makes a very hot fire inside of it, but as an exposure it is very much better than frame and almost equal to brick.

Fireproof Construction.

H-3297. Building supposed to have been fireproof, but owing to the large amount of inflammable material in transformer room, the building was badly damaged.

Fire Divisions.

H-4968. Fire originated in portion of brick, open joist light station used for workshops, offices, etc., and was cut off by good brick fire wall from power house. Wall had a four-foot parapet and good tin-clad fire doors at door openings. This fire wall prevented a large loss.

H-6455. Cut-offs, although not standard, saved large loss through spread of fire to adjoining sections containing large values. Fire door to boiler house operated. Fire door to another section had been removed and door enlarged to remove some machinery, but fire department held fire at this point.

Poor Construction.

H-4968. Light construction and open stairs helped the spread of flames. Station was brick, of light open joist construction.

Poor Judgment.

H-910. Three men who were on duty tried for half an hour to extinguish fire, which had caught on roof from boiler stack. Only when it was too late, did they call for city department. Loss over $100,000. There was said to have been steam enough in the boilers to have risen with sufficient density, on being released, to have put out the fire. The hose and water at hand should have been enough. Men lost their heads.

Water Pails.

H-5388. After dynamo tender noticed fire behind switchboard, he promptly shut off current and endeavored to extinguish fire by means of sand and dry powder tubes. He made little progress with these agencies, but secured a pail of water and sprayed water upon the fire with his hand and extinguished it.

Miscellaneous.

H-1540. Building, in addition to being used as a power station, contained gas blower pumps, taking gas from gasometer and blowing into city gas mains. The cylinder head of one of these pumps blew off, and the flow of gas materially assisted in the destruction of the premises.

H-385. This fire illustrates the necessity of isolating electric power stations from pumping machinery and the building of fireproof or substantial brick structure to contain plants of this kind.

H-769. The defect shown to prevail here was the locating of the gas apparatus in non-fireproof building, with open communication between the building and the main structure. Also the exposure of the gas mains above ground, together with the feature of the apparatus being yet operated experimentally.

H-2125. This fire pointed out that the generator should be so related to the rest of the system that it will be automatically entirely disconnected from the system in similar cases. Also that generator pits contain only non-combustible material, and be so cut off that fire in the pit cannot communicate to any part of the building below the floor.

H-2218. Following conclusions were formed as a result of this fire :—

1. That a wooden floor and a low roof with exposed iron truss are undesirable in a power house.

2. That a thermostatic alarm system would be desirable where there is any combustible material.

3. That all oils, etc., should be stored in a fireproof room cut off from other parts of building.

4. That for properties where the outside protection is deficient, an independent water supply be provided.

8. SPRINKLER FIRE RECORD.

S-403. Fire occurred at the window casing in a coat closet of office, due to crossed wires between a telephone grounded circuit and alternating

current circuit outside of building. One sprinkler opened and extinguished fire. Supply was a 35,000-gallon gravity tank, giving about six pounds on sprinkler that operated.

S-8953. The building where this fire occurred was of irregular shape, about 70 feet long and 20 feet wide on the average, and was constructed over the flume. This building was occupied in part by an electric light and power company and by a paper manufacturing company for electrical apparatus, the latter owning the building. The floor on which the electrical machinery stood was of very heavy construction, and this heavy timbered floor was quite badly burned from the underside, over perhaps about one third of its area.

In the light company's portion of the main floor were two dynamos and a switchboard, the larger of the two dynamos being a 400 K. W. 2300 V. three-phase machine, and the smaller a 100 K. W. 600 V. direct current railway generator. In the paper company's portion of the room there were two old Edison 60 K. W. 110 V. generators and a T-H 50-light series arc generator, which at the time of the fire was down for repairs. The Electric Light and Power Company was a public service company, and furnished current for street and residence lighting, and to various small power users, including the local street railway. The generators owned by the paper company supplied current for lighting their buildings.

Sprinklers were supplied by waterworks, giving a static pressure of 124 pounds on the sprinklers that operated.

At 5.15 p. m., with all this machinery running, except as noted, a 2,300 V. cartridge type fuse on the switchboard, protecting one of the high constant potential street circuits, blew and the arc was maintained across the terminals for a minute or two. The exact cause of the blowing of the fuse was not known, but an investigation after the fire showed that a cut-out on one of the street poles had operated, and it was thought that a short circuit on the line was the direct cause of the trouble. The location of this short circuit was not discovered. During the arcing of the fuse, sparks were thrown onto the belt of the large dynamo. This belt ran down through the floor into the basement, from whence power was derived. These sparks, carried down by the belt, started a fire in the basement. Nine sprinklers operated and held fire in check. Owing to the construction and some sheathing, the sprinklers had difficulty in extinguishing the fire, and hose streams were required. The fire also came up through the belt holes into the dynamo room, but the damage in this room was not extensive. Water was on the sprinklers in basement, but was shut off by permission in the dynamo room on account of the high voltage apparatus. There was no evidence that showed this procedure was not justified.

The fire proved very difficult to extinguish, owing to the peculiar construction of the flume, and kept breaking out at intervals until seven o'clock the next morning. There seemed to have been good judgment and energetic action used in fighting this fire. The switchboard attendant was commended for cutting current off of the various generators and circuits, and

for shutting down the water wheels before he was driven from the room. Had he not done so, it is the general opinion that the fire would have been more serious, and probably the building destroyed. From the appearance of the sprinklers in the dynamo room, and especially considering that the water was shut off, there did not seem to have been the proper number of heads opened, and it was recommended that the heads in that room be replaced by new ones. The heads in the basement operated satisfactorily.

S-1715. This was a brick, four-story electric light station. Floors were open joist, except ceiling of second floor was wood sheathed. First floor contained generator, dynamos on the second, repair shop third, and storage room fourth. Building was equipped with Grinnell glass button and Gray sprinklers. Pipe sizes were old schedule, with corner feed. Primary supply was waterworks, having a six-inch connection from a four-inch main, which was fed both ends by a ten and twelve inch main. Pressure was 75 to 80 pounds. The sprinklers on the first and second floors were on the dry system, controlled by a Gray toggle joint dry valve.

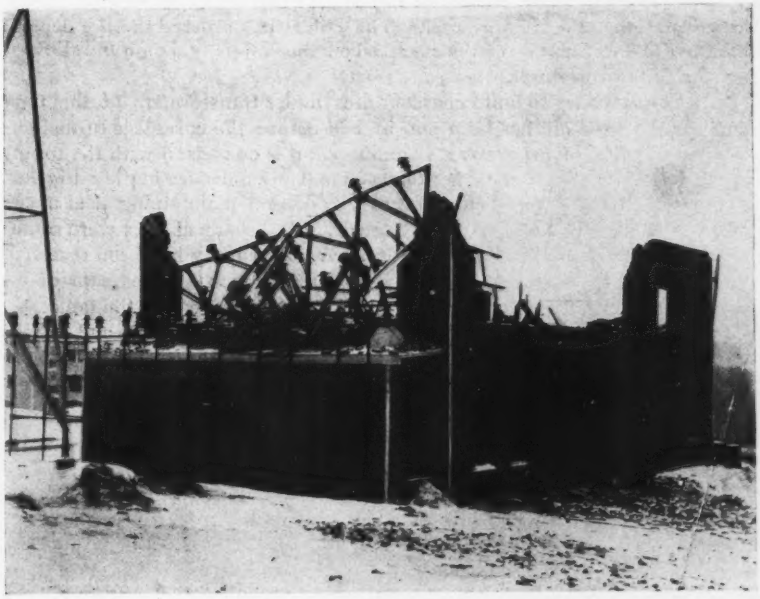
The fire apparently started back of or around the switchboard on a gallery first floor. There were no sprinklers in this vicinity, and fire spread rapidly to the second floor, which was gutted, and then spread to fourth floor, evidently from the outside. The roof was burned and considerable stock destroyed. All of the sprinklers on second and fourth floors and about half on third floor opened and failed to hold the fire. Pressure was reduced to a negligible quantity. Public fire department used eight or ten hose streams. Total loss about $75,000, which was about twenty-five per cent of total value.

9. TRANSFORMER FIRES.

H-5090. Transformer House. Fire occurred at 11.11 p. m. The cause was due to oil escaping from a transformer becoming ignited from a charcoal fire used to heat the transformer. The fire was first fought by the attendants with sand, later by the fire department with chemical extinguishers, and finally by a hose stream. The hose stream had practically no effect, and after the walls of the building had fallen out, the chief ordered the department home, leaving a chemical engine company to take care of any sparks which came from the fire. The fire was not entirely out until the second day thereafter.

The building was of brick, approximately seventy-one feet by thirty-nine feet by twenty-seven feet high. The height was one story except at either end, where there were galleries. The roof was iron-trussed, concrete graveled. Floors were of concrete, stairs of iron, and partition walls around office and lightning arrester room were of brick. Heating was by boiler in the basement. This was well set and had a suitable chimney.

The apparatus consisted of three 1,500 K. W. oil-filled water-cooled transformers, with 66,000-volt primaries, and 13,200-volt secondaries. Power was to be received from another power station, although the current



Transformer Station Fire No. H-5090.

had not been turned on the apparatus. The building was unexposed and was something like 1,800 feet from a hydrant, a fire department house being located about one mile from the building.

The nearest fire department received the alarm by telephone from the fire department headquarters. They responded with a hose wagon and five men. The wagon carried two six-gallon and two three-gallon chemical extinguishers. When they reached the building, about five minutes after the alarm was received, the fire was apparently on the floor between two of the transformers. It was said that the streams from these portable chemical extinguishers which were used had good results, and it was believed that a chemical engine might have extinguished the fire. After extinguishers were exhausted, they telephoned to headquarters and requested that the chemical engine be sent from the city, but as the fire continued to increase, they again telephoned and asked for an alarm to be rung in. On the first wagon which answered was 1,000 feet of hose. This was laid from the hydrant about 1,800 feet from the station, and upon the arrival of more apparatus, 800 feet additional hose was laid, which fed one stream through a steamer.

It was claimed that the water had no appreciable effect on the fire other than to apparently make it more intense. While the department were

at work, the north and south walls fell out, burying three men, one being killed and the other two injured. The chief then ordered the fire department, with the exception of the chemical engine company, home and allowed the fire to burn itself out.

It is customary to build charcoal fires under transformers of this type and size after the oil has been put in and before the current is turned on. While the fire is in progress, a vacuum pump is connected with the top of the transformer case, the air is exhausted and any moisture in the oil is thus removed. On the day of the fire, they had been maintaining heat under these transformers from about 10 a. m., but the charcoal fires were somewhat low, as the charcoal had run out. A new supply had been received, and when they went to replenish the fire they noticed this stream of oil which was probably coming round from the valve by which the tank was drained. The tanks were examined the fourth day after fire, and it was found that all of the oil had been burned out of the two transformers, the bottom casting of the tanks cracked and the cases practically ruined. The remaining transformer had about 1,000 gallons of oil in it (total capacity being about 1,500). When the oil was taken out of this last transformer, it was found that the insulation of the coils was charred and it was the opinion that the transformer was ruined. The switchboard was badly damaged, as the heat had caused the slate to crack. The low tension switches, however, which were in cells at the rear of the switchboard, were but little injured. The lightning arresters were only a little damaged.

H-1022. This transformer house was built of brick, thirty-six by sixty feet, side walls twenty-four feet high and end walls thirty feet high. Thickness of walls sixteen and twenty inches. Slate roof on steel truss, and four ten-inch steel girders forty feet long. There were four partition walls for transformer cells, twelve by twelve feet and twelve inches thick. Building contained 13-550 K. W. 1,000 to 30,000 volt transformers, oil insulated and air cooled.

The high tension switchboard was on a gallery which was supported from the trusses of the roof, and in many respects was an arc plug switchboard.

The immediate cause of the fire was not definitely known, but it is supposed to have been caused by transformer burning out and setting fire to the oil. The tanks which contained the transformers were made of about No. 16 iron, which was riveted and soldered together at the joints. When the oil caught fire, the solder melted and allowed the oil to run over the floor and down the shaft, setting fire to the insulated wire and the wooden supports to which the wires were fastened. All the wiring on the shaft was rubber-covered, and when it caught fire it burned rapidly.

Only three of the transformers were fit to be used at all, and they burned out in about four days after being put in service.

The only fire protection was a half dozen chemical fire extinguishers and a water tank containing about 2,000 gallons of water. The tank was kept filled with water by means of an electric pump supplied with current

from the switchboard in the cavity. When the fire started, all the apparatus in the cavity was shut down, which left them without means of keeping their tank filled with water. They reported very favorable results from the fire extinguishers, but they did not have enough on hand to subdue the fire after it once got started.

All wiring in the shaft and transformers in the building were a complete loss, except for the scrap iron and copper.

H-1447. This was an electric railway brick power house, containing two stories and basement. There was a one-story engine room and a cut off boiler room. Transformers were located in basement under the dynamo and engine room. Plant had private fire protection, consisting of pipe line from artificial lake, which gave very good pressure. Private hydrants were provided with hose houses and there was a standpipe inside.

Fire occurred on evening of Labor Day, when there had been an excessive travel on the car line, and the machinery had been overtaxed during the entire day and evening. It was stated that the power plant was only about half the capacity which it should have been to meet the increased traffic.

Fire undoubtedly was caused by an overload, which caused an air-cooled transformer in the basement to explode. An oil-cooled transformer nearby was ignited. The fire was discovered by the engineer very shortly after it started, and the current of electricity was immediately cut off and all the help that could be had about the plant summoned. Water was immediately turned into the basement, and engineer started the pumps and increased the pressure. It is claimed that the fire spread very rapidly over the wires and that the explosion of the oil transformers spread the fire in the basement, so that it was only a short time until that entire division of the building was on fire. The roof soon fell in, breaking down the steam connections and at once shutting off the use of water. The falling of the roof of that part of the building broke down the upper portion of the fire wall between the boiler and engine room, and allowed the fire to pass into the boiler room, thus entirely destroying the whole power plant.

H-5010. This was a brick electric railway power house. Transformer room was on first floor. A short circuit occurred in room. Details were not reported.

10. MISCELLANEOUS ELECTRICAL FIRES.

H-6381. Summary. The building was one-story brick, of good construction, used as a hydro-electric power plant, practically unexposed. Generators and exciters were driven by hydraulic turbines, operating on an 82-foot head. Current was 60-cycle, 3-phase, generated at 800 volts and stepped up to 25,000 volts, at which potential it was carried on pole line to city, where it was reduced for commercial distribution to 2,300 volts. Hazards were few and well guarded. There was no public protection and no private protection except chemical extinguishers. Plant was considered practically free from fire hazard and no insurance was carried. The value of the plant was approximately $140,000, of which $40,000 was apportioned to building and $100,000 to machinery. The damage was as follows:—

By fire to building $1,500; to contents practically nothing.

By electricity to one generator about $2,500.

Construction.

Walls: Generator Room brick, 16 inches, about 26 feet to eaves, with 12 by 24 inch pilasters practically every 17 feet 2 inches on centers to a height of 18 feet. Pilasters support the 18-inch I-beams carrying the 20-ton crane.

Turbine Room brick, 12 inches, 14 feet to eaves on south.

Lightning Arrester House brick, 8 inches, 11 feet to eaves.

Area: 7,300 square feet.

Roof: No. 28 U. S. Gage iron on 2-inch dressed, matched lumber on 5½ by 9 inch timbers on metal trusses. A frame ventilator 8 by 6 by 17 feet with thin glass windows was located over center of generator room.

Along the north and south sides of this ventilator and 18 inches distant from it was erected a frame barrier to prevent rain from driving in while windows were open. This barrier was carried up to within a foot of the ventilator roof which had been extended to properly cover the barrier.

Floors: Generator Room mostly concrete with some wood floor back of switchboard and two small decks or platforms of iron supporting water wheel governors.

Turbine Room mostly without flooring. A 2-inch plank platform 22 by 26 feet is located on level with engine room in middle of room, together with a deck 8 feet wide and 88 feet long of 2-inch plank along the south wall and about 8 feet above the level of the generator room floor.

Two-inch plank floor in Machine Shop about 18 by 22 feet.

Partitions: Small amount of frame partition in Machine Shop, also frame boxing for air chamber in connection with air-cooled transformers. Small amount of concealed space.

Electrical Equipment.

Four G. E., 750 K. W., 3-phase, 800-volt, 60-cycle generators, each directly connected to a Victor Turbine developing about 1,200 H. P.

Two G. E., 65 K. W., 125-volt D. C. exciters, each connected to a 100 H. P. Victor Turbine.

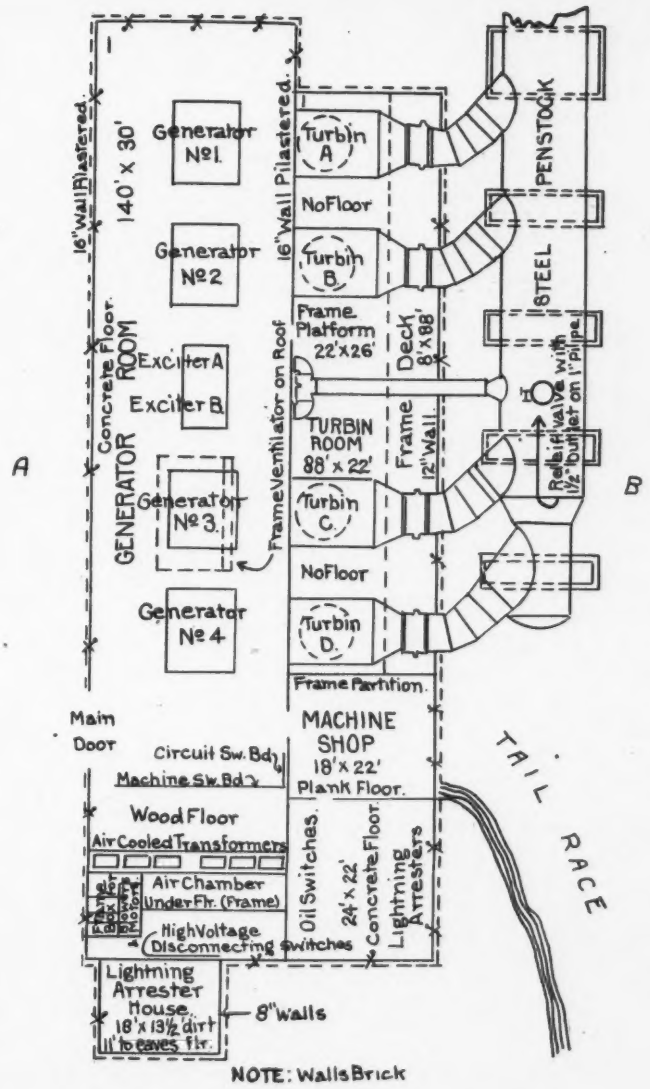
Six G. E., 500 K. W., 800 to 25,000 volt, air-cooled transformers with two Buffalo Forge Company's blowers, motor driven.

One 15 K. W. oil-cooled transformer for station lights.

Marble switchboard on angle steel frame.

Hazards.

Premises kept clean. **Oil** in metal receptacles on wood platform in generator room. **Clean waste** in frame bin in generator room, main supply in open bale on deck in turbine room. **Forge** on wood floor in machine shop. **Heating** occasionally by electric heaters. Heat given off by electrical equipment usually sufficient. **Electrical hazards** well guarded except lightning arresters on frame supports, frame work about transformers and back of switchboard, oil transformer on wood floor, switchboard wiring not modern. Heater installation not standard but infrequently used.



NOTE: Walls Brick

GENERAL DIAGRAM, SHOWING FLOOR PLAN AND RELATIVE LOCATION OF FRAME VENTILATOR ON ROOF.

Exposure.

Mild from frame stable 250 feet distant.

Protection.

Public—none.
Private—three chemical extinguishers.

Description of the Fire.

Operating conditions: During the day of fire generators Nos. 2, 3 and 4 were in operation, carrying about 25 per cent overload, which had been the practice in order to produce a suitable efficiency. The machines were rated to generate 800 volts difference of potential, but it was not unusual to increase this to 900 volts, and at the time of the fire they were developing about 900 volts, running at a speed of 300 R. P. M.

Neither this slight increase in voltage nor the 25 to 30 per cent overload was considered dangerous by the builders of the machines, and during the ten years of operation no trouble was experienced from this practice, and it is believed that the failure which caused the fire was not due primarily to this excessive duty.

Machine design: The machines were of a design popular in 1901, known as the revolving armature type, and on account of the low generating voltage the windings were quite heavy, consisting of copper bars $\frac{1}{4}$ by $\frac{3}{4}$ inch insulated with varnished cambric and paper. These were held in slots by wooden wedges, fitted into grooves in the armature core, together with the usual wire bands employed to hold the windings in place.

The accident: Nothing unusual occurred during the day, but at about 5 p. m. the day operator, while seated at his desk in front of the switchboard, heard an unusual noise behind him, and looking about, saw some flashing on No. 3 generator. He thought the transmission lines were short circuited and rushed to the circuit panels and opened the switches, but the flashing continued, and while he was studying the switchboard and considering his next move, a copper bar, thrown from the machine in trouble, struck him in the back, and without further delay he dashed into the machine shop nearby and notified superintendent. Superintendent rushed to the door to enter the generator room, but the hail of copper bars and the spatter of molten copper against the switchboard convinced him that it would be fatal to attempt to get to the field switch which was then in the thick of the storm. He climbed out of a window and ran around the building to the front of the plant and attempted to enter the room through the main door, but the bombardment of copper continued. As he looked through the door he noticed that the west end of the ventilator was afire. The frame bin in which the clean waste was stored was also blazing and the high voltage current was arching from a broken disconnecting switch to its grounded iron support in the west end of the room. Generator No. 3 was afire and resembled a huge fireworks pin wheel in operation.

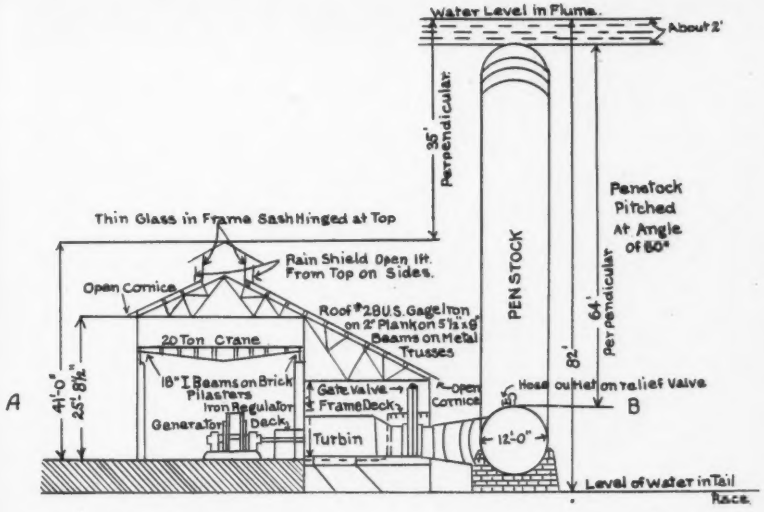


DIAGRAM SHOWING CROSS SECTION AT A-B.

Note:- Penstock is shown at this point to present the relative height of water & roof of frame ventilator.

Fighting the Fire.

Rain shield blocks chemical streams: Two men were at once sent to the roof with chemical extinguishers to handle the fire in the ventilator, but returned shortly to report that the rain shield prevented them from reaching the fire with the extinguishers. Roof was reached by means of a ladder resting on a couple of planks extending from the penstock to a window sill in the south wall of the turbine room.

Plant shut down: Superintendent seeing that it was impossible to cut off the exciter current, and remove the short circuit, decided that the water wheel operating No. 3 machine must be stopped. The only quick acting controlling valve in the plant was on the water wheel governor near the burning machine, which was dangerous to approach, therefore two men were at once ordered to go to the head of the penstock to drop the gates, cutting off all the water. This was accomplished with dispatch and within two minutes all the wheels were stopped. The governor valves were at once closed and water again turned into the penstock for fire service.

Chemicals of no avail: An effort was made to reach the fire in the ventilator with chemical extinguisher streams from the floor, but they fell far short. These had been freshly charged in December last, and were apparently in good condition.

1-inch hose in service: Attached to the relief valve of the penstock was a 1-inch pipe equipped with a 1½-inch hose outlet fitting. The hose used in connection with blower system for cleaning machines and board, also for cooling the transformers, was ordered attached to this outlet. The hose was of the "common garden variety," 1-inch in diameter and not equipped with proper coupling to fit outlet. It was necessary to cut off the coupling, split the hose and bind it on the outlet by means of bagging and ropes and, with the further assistance of a man to hold it in place, it was ready for service.

Water pressure inadequate: When the lead was brought into the generator room the stream from the ½-inch nozzle failed to reach the fire and was withdrawn at once and carried to the roof, where four men were put to work tearing off the metal roof covering and wetting down the planks. Water buckets were also used. In this way good work was done in preventing the rapid spread of the flames. As soon as the cupola collapsed the burning woodwork visible through the opening thus created was also drenched. Special care was exercised to keep all doors and windows closed to prevent draughts from aiding combustion.

Help arrives: As soon as the penstock gates were cared for the teamster who assisted in this work was dispatched with team for help to the neighboring power house at a village, some three and one-half miles up the river. Requests for assistance were also telephoned to the city, which brought responses. The teamster returned within an hour with several men and 150 feet of 2-inch unlined linen hose, and a strong bucket brigade was organized.

Stream from 2-inch hose extinguishes fire: The 1-inch hose was disconnected from outlet on penstock relief valve and the 2-inch substituted. This hose was without a play pipe and an effective stream was secured by restricting the discharge orifice manually. Holes were cut in the roof at various points along the south side and through these a stream was played against the under side of the roof on the north side of the building until all of the fire was extinguished on that side. Then two men were placed on the crane with the hose and all the fire on the south side was extinguished. Later there was some rekindling and a few small fires developed in various parts of the building, but every visible sign of fire had vanished at 2 a. m., and at 2.45 a. m. superintendent and all of the men except three, who were left to watch, retired, believing that all was safe.

Fire starts in frame air chamber: At 3 a. m. the men on watch discovered smoke coming from under one of the blowers used in connection with the air blast system for cooling transformers. The woodwork was soon torn away and the fire extinguished. The next day an investi-

gation developed the presence of two copper bars from the wrecked machine on the floor of the air chamber. These must have been thrown through the fans or burned their way through the frame covering of the air chamber, causing a smoldering fire which broke into flames later.

Employees laud metal roof covering: General superintendent and station superintendent were of the opinion that the heavy metal covering of the roof was a deciding factor in the saving of the plant, and they felt quite sure that any ordinary combustible roof covering would have permitted the fire to burn through in places, gain ventilation and have gotten beyond control before the 2-inch hose could have arrived to give them an effective fire stream.

Damage.

Fire damage practically confined to woodwork of roof: Some idea may be gained of the efficient service of this untrained brigade with primitive apparatus, intelligently directed, from the fact that the fire which burned for nine hours did no appreciable damage to the metal roof trusses and only slightly warped an angle iron tie rod connecting the trusses located at each end of the ventilator, it being so placed that the collapsed ventilator while burning fell across it.

Repairs to Roof cost approximately $1,500.

Waterproof Covers Arrive: The day following the fire waterproof covers were received, and gaps in the roof were covered pending repairs, which were started immediately. The premises were cleaned up and the electrical machinery carefully inspected and all dirt removed. These were allowed to dry for 24 hours and later were slowly put in operation at greatly reduced voltage to accelerate the drying-out process.

Plant again in Operation: Within 84 hours from the time the fire was extinguished the entire plant was in full operation, with the exception of the electrically injured generator.

Repairs to Generator cost approximately $2,500.

Cause.

The fire undoubtedly was caused by a short circuit in the armature of No. 3 generator, which burned through its windings consisting of $\frac{1}{4}$ by $\frac{3}{4}$ inch copper bars, together with the binding wires which held them in place, permitting the hot bars and molten copper to be thrown off by the centrifugal force of the revolving armature. Some of this hot metal being projected upward, lodged in the ventilator and ignited the framework. The open waste bin was also fired in this manner.

Cause of Short Circuit: The conditions which produced the short circuit in the armature of No. 3 machine have not been absolutely defined. The location of the generator immediately under the ventilator exposed it to much of the moisture which entered at this point, and it is possible that considerable damage was done before the shield was installed, or the shield may not have been entirely effective during the driving rain storms which occurred.

In view of the foregoing it seems probable that the moisture which came upon the machine from time to time gradually produced a weak spot in the insulation, which gave way and caused the short circuit. The machines were operating under normal conditions and at the usual speed of 300 R. P. M.

H-6534. June 18, 1911. During a severe rain and wind storm at about 1.30 a. m. a heavy lightning discharge entered the power house, instantly igniting the wood in roof above switchboard, the insulation on switchboard conductors and some wooden wire-racks above the switchboard. The resulting fire entirely destroyed the part of building known as engine and dynamo house, the marble switchboard and appliances, three series arc regulators and severely damaged the five electric generators. The damage to

Fire No. H-6534.

engines was not serious, amounting to loss of oil cups, cylinder lagging and finish. The boiler house was not damaged to any extent. Original cost of buildings and machinery $150,000. Loss was heavy.

Construction of Building. Engine and dynamo house one story, hollow cement block, walls 10 inches thick, area 3,000 square feet with a skeleton iron-clad addition of 1,500 square feet area. Ordinary gabled roof, one inch wood sheathing, wood trusses and supports, covered with composition roofing. Open finish walls and ceiling. Concrete floors excepting small portion wood around engines and over wire trenches. Height of roof directly over switchboard about 20 feet. Boiler house: One story brick building, 12-inch walls without parapets. Ordinary gabled composi-

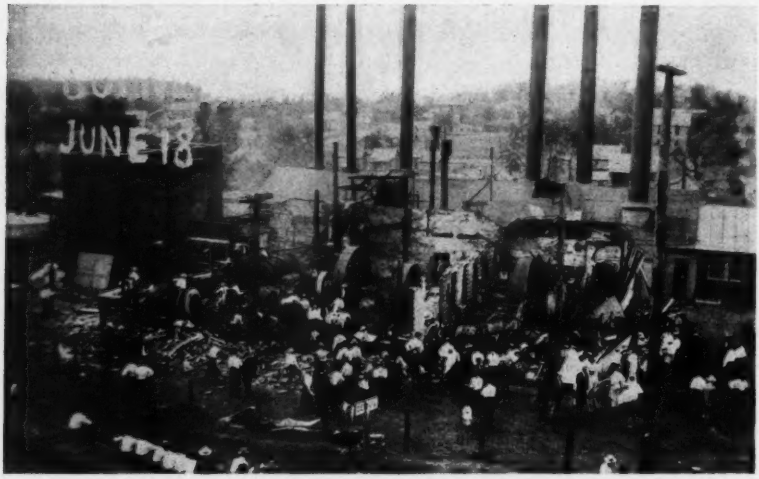
tion roof with wood trusses and sheathing. Detached five feet from engine house. Connected by covered passageway and unprotected openings. Brick and cement floor. Open finish. Frame coal shed attached.

Machinery. One three-phase 2,300-volt 500 K. W. Westinghouse alternator direct connected to a Westinghouse-Parsons steam turbine. Two General electric three-phase 2,300-volt 200 K. W. belt driven alternators. One General Electric 600-volt 200 K. W. D. C. belt driven street railway generator. One General Electric 325 K. W. motor generator set. Three 30 K. W. General Electric series arc regulators. Marble switchboard and standard equipment. All lines equipped with lightning arresters. One 300 H. P., one 200 H. P., and one 400 H. P., Corliss engines belted direct.

Boilers. Four 80 H. P. horizontal fire tube, two 250 H. P. marine and one 500 H. P. water tube. Metal stacks.

Arrangement. Switchboard located in north end of engine house, set out about three feet from end of building. Lightning arresters mounted above switchboard on wooden frame bolted to wall. Dynamos located across the north end of room with engines and pumps near south end. Boiler house south of engine room.

Account of Fire. At time of fire two men, an engineer and fireman, were on duty with only the steam turbine unit in operation. The engineer was a short distance from switchboard when the lightning struck, in the vicinity of switchboard, seeming to cover the entire switchboard and roof above in a sheet of flame. He at once sprang to the board and threw out the switch, cutting off all current, and then turned a stream of water on the fire from a line of 2-inch hose that was connected to an inside standpipe within 30 feet of board. Seeing that he could not control the fire with this stream, he instructed the fireman to notify the fire department by telephone. Finding the telephone out of order the fireman, after turning off the gas under the boilers and blowing the whistle, set out afoot to the nearest fire station, a distance of about four and one-half blocks. In the meantime the fire had gained such headway that the engineer abandoned the hose stream and gave his attention to stopping the turbine and shutting the gas off at the pressure regulator outside. Before the man reached the fire station the flames had been seen by the firemen, who at once responded. Some delay was occasioned by the firemen having to go a couple of blocks out of their way on account of a subway crossing under the railroad track being flooded. The chief in making this point was forced to swim his horse some little distance. The two other fire companies saw the flames and reached the fire some ten minutes after the first department. Four lines of hose were turned on the building, also two 2-inch hose lines in boiler room were used. By the time water was turned on the building the entire roof over engine room was afire, with parts of roof falling in, and when water struck the cement block walls they crumbled and collapsed. The water pressure was good and department easily confined fire to the engine room, with only a slight damage to the roof of boiler house. From information obtainable it



Fire No. H-6534.

is estimated that from 20 to 25 minutes elapsed after fire started before the fire department had a stream of water on the burning building. The city fire department consists of three hose companies of three regular men each, and chief with horse and buggy, also one ladder wagon not in service. The nearest hydrant used during this fire was directly across the street about 100 feet distant, also two other hydrants within 400 feet, all on 6-inch mains. Gravity pressure.

H-6428. May 6, 1911. This building was of brick, arch construction, eight stories high, occupied solely by the Electric Company.

The fire occurred on first floor from a defect in an equalizing apparatus, which set fire to the insulation on the network of cables extending all over the room and up through an opening to the second floor. After about a half hour's work the firemen extinguished the fire.

The burning of the insulation made a dense smoke and considerable amount of water was thrown into the building. The machinery and cables were badly damaged by fire and water and crippled the operation of the plant for a couple of days.

Machinery loss about $200,000.

Special Fire.

Short Circuit on a Service Conduit. On June the 10th at about 6 p. m. a fire started in a two-story brick, composition roof building, occupied on first floor by a moving picture theatre. A rooming house was located on second floor.

A 220-volt direct current circuit entering in the rear of first floor became short circuited in the service conduit, melting the conduit and steel cabinet like wax. The wiring was all in conduit run open on metal ceiling and not grounded. The metal ceiling was connected to a tin roof of an adjoining two-story brick building, and this metal roof was grounded by two four-inch cast-iron soil pipes. The connection between the roof and soil pipes was poor, causing a severe arcing at this point, setting fire to the surrounding woodwork.

The picture theatre was filled with smoke and would probably have caused a panic had there been a show in progress. One of the service wires became red hot from building to pole, setting fire to the insulation. This was noticed by some one passing by and a fire alarm turned in. The circuit was not broken until firemen cut the service wires at the pole.

This circuit with three-wire 220–440 volt feeders is used mainly for power purposes with a heavy amperage. The neutral is permanently grounded at power house and several places on lines.

The cause of the break down of the insulation on the wire in conduit was probably on account of injury to the insulation in pulling in the wires, as the wires were No. 4 single braid and not stranded. Size of conduit one inch. Damage about $100.

Bell Ringing Transformer Fire. A fire occurred on the morning of the 2d inst. about 10 o'clock in a public school building. Investigation developed the fact that it was caused by a breakdown in a bell ringing transformer of an unapproved make, which was used in connection with a system of electric clocks. The breaking down of the transformer allowed the 110-volt current to pass over clock wires which were duplex weatherproof bell wire and were poorly insulated. The fire started under roof and did about $3,000 damage before it was extinguished.

GENERAL FIRE RECORD.

Unsatisfactory or Serious Fires in Buildings Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

S-11135. February 28, 1911. Locomotive Works. The sprinklers in pattern storehouse were on the air system, the dry pipe valve being located in a small house at the side. This valve house was heated by steam, and as the pipes were found to be frozen, employees were sent to thaw them out. The one and one-quarter inch pipe supplying the steam was disconnected inside of valve house and a small piece of lighted waste was used. After thawing out this pipe, the pipes on the sides of the valve house were taken down and removed to the boiler house. It was during the absence of these men that an employee at work in one end of the storehouse saw smoke and gave the alarm. The employee soon had one hose stream from a nearby hydrant in operation inside of the pattern storehouse.

The fire apparently had a good start, as it damaged the roof and side near the valve house and also destroyed the patterns for locomotive parts which were stored in racks. The heat spreading out through the room opened 113 sprinkler heads. An examination of the heads which had been removed showed three which had been subjected to intense heat.

It was stated that the alarm on the system rang and that the valve fully opened, so that it seems probable that there was an ice plug below the valve which was later thawed out by the heat from the fire in the valve house.

The fire was undoubtedly caused by a piece of the burning waste being dropped at the side of wooden wall of pattern house, the fire working through to the other side.

Lesson: This fire brings out the importance of a reliable method of heating dry valve houses to prevent freezing, and of proper insulation of all underground and exposed pipe up to the dry valve.

11072. June 15, 1911. Report of fire destroying the following premises: Huttig Sash and Door Company, Fathman-Miller Planing Mill Company, Missouri Stair Company, Mound City Box Factory and Koken Iron Works, together with lumber yards No. 1016-34 S. Vandeventer Avenue, St. Louis, Mo.

Construction of Buildings. Huttig Sash and Door Company's warehouse: area 130 by 200 feet, three stories and basement, brick, gravel roof, open joist construction, open stairs and elevators, frame awning twenty feet wide attached to south side.

Mill building located 40 feet north of warehouse was two stories and basement, brick, gravel roof, open joist construction, stairs and elevators open, area 125 by 200 feet. To this building were attached the one and two-story brick, joist constructed shavings house, boiler room, engine room and dry kiln. These buildings were of comparatively small area and were partly cut off by fire doors.

Stable located thirty feet north of mill, area 40 by 80 feet, one and two stories, brick and frame, gravel roof, open joist construction, stairs open.

Fathman & Miller Planing Mill Company, *et al.* Mill buildings of respective area 130 by 160 and 100 by 130 feet, two stories, brick, gravel roof, open joist construction, open stairs and elevators. The openings in partition wall between the two buildings were covered with double metal-clad doors. Adjoining the rear were the one and two-story brick and frame engine room, boiler room, dry house, lumber shed and warehouse, stable and buggy shed. This plant is located twenty feet north of the stable of the Huttig Sash and Door Company.

Koken Iron Works. Two-story brick foundry, area 50 by 150 feet, and one-story brick pattern storage house, area 25 by 75 feet. These buildings were located about 200 feet north of the Fathman & Miller plant.

Exterior openings on all the buildings described were unprotected.

To the east and south of the Huttig Sash and Door Company and the Fathman & Miller Company's plant were located the two firms' lumber yards, also a frame and metal-clad lumber and storage shed. These yards cover about four acres of ground, the lumber being piled within about fifty feet of the buildings. The Missouri Pacific Railroad Company's tracks extend along the east side of the yards.

Occupancy: Huttig Sash and Door Company. The warehouse was heavily stocked with sash, doors, blinds, mouldings, etc., crating of stock, glazing and painting, two dipping tanks with naphtha mixed paint and moderate supply of paints, varnish and oils.

Mill building, planing mill and general woodworking; shafting for operating machinery in the basement; first and second floors contained about sixty woodworking machines, cabinet making and assembling; blowers were provided for drawing shavings from machines through dust collector to the shavings house.

Fathman & Miller Planing Mill Company, *et al.* This plant was occupied jointly by the Fathman & Miller Planing Mill Company, Missouri Stair Company, Mound City Box Company, as a general woodworking plant, box making, cabinet making, painting and varnishing.

Koken Iron Works. Foundry and storage of patterns. The lumber yard contained about four million feet of seasoned lumber, also frame lumber and storage sheds. The lumber was closely, but orderly, piled with aisles fifteen feet wide, systematically laid out.

Fire Protection. The Huttig Sash and Door Company. Warehouse, mill, shavings house, boiler house, engine house and dry kiln were equipped with a standard dry pipe automatic sprinkler equipment, installed when the buildings were erected in 1903 by the Niagara Fire Extinguisher Company, whose devices were used. The equipment consisted of eight five-inch dry systems. The sprinkler heads were staggered and covered an area of from 64 to 80 square feet each. The pipe sizes were according to rules in force at time of installation. There were 1,069 heads on the four systems, protecting all buildings except dry kiln; largest number on any floor of one building, 343. There were 1,491 heads on the four systems protecting dry kiln, including 54 under the awning; largest number on one floor 363. The equipment was supplied through an eight-inch underground circulating main by two six-inch city connections taken from a twelve-inch city main; pressure 50 pounds. One gravity tank of 30,000 gallons capacity, supported upon an independent steel structure 71 feet high and four four-inch steamer connections. The alarm of equipment was extended to the fire engine house one-half block distant. Night watchman with central station signal boxes distributed throughout the premises, including three in the lumber yard. Public fire alarm box on the premises of the Huttig Sash and Door Company located between the warehouse and the mill. Water barrels with buckets and three-gallon chemical fire extinguishers were distributed on each floor of the buildings of the Huttig Sash and Door Company.

In the Fathman and Miller Plant, water barrels and buckets were distributed throughout the buildings. Inside standpipe supplied from the city main with 150 feet of one and one-quarter inch hose attached on each floor of building. Night watchman with stationary clock, seven stations.

Koken Iron Works. Protection not known.

Cause and Development of Fire. The fire is supposed to have been caused from sparks from passing locomotives, as fires had previously occurred in this manner.

The fire originated in a pile of wood lath in the east side of the lumber yard near the railroad tracks at about 6.10 p. m., the pile of wood being about 200 feet east of factory and warehouse building. The fire was first discovered by a watchman in the premises of the R. N. Collins Carriage Woodworking Company, located about 150 feet east of the east end of the lumber yard of the Huttig Sash and Door Company. This watchman turned in a still alarm for the fire from his watchman's A. D. T. signal system box; an alarm was also turned in at 6.11 p. m. from the public fire alarm box in yard of Bell Telephone Company, located about 500 feet east of the east end of lumber yard. A few moments later the smoke of the fire was discovered by one of the foremen of the Huttig

Sash and Door Company plant, and he turned in an additional alarm from the public fire alarm box.

Engine company which is located on the opposite side of the street from the plant of the Huttig Sash and Door Company responded to the alarm, but as there were no water mains or fire plugs on the east of the lumber yard, this space being occupied by railway tracks, it was necessary to extend about 1,000 feet of hose from Vandeventer Avenue, which is the west boundary of the plant, to the scene of the fire. A freight car on the switch track near the burning fire obstructed the progress of the firemen to some extent, and their hose was burned before they were enabled to obtain water, and the burned section had to be replaced, which caused considerable delay.

The delay in obtaining water promptly through the hose was afterwards ascertained to have been caused by the kinking of the hose about the engine, and the work of this engine company was not effective. Before other engine companies arrived, the fire feeding upon the sun-dried lumber under a brisk wind had traveled with great rapidity through the high lumber piles and soon developed into a conflagration.

The local U. S. Weather Bureau records the wind velocity at from seven miles at 6 p. m. to sixteen miles at 9 p. m. and ten miles at 11 p. m., direction southeast. The buildings of both plants being directly in the path of the wind, they were practically enveloped in flames, and the unsprinklered buildings, containing much combustible material, were in a short time all ablaze.

The automatic sprinklers in the buildings of the Huttig Sash and Door Company operated and, until the water in the gravity tank was exhausted, held the fire in these buildings in check. There was a heavy drain upon the twelve-inch city main in Vandeventer Avenue from the numerous engines attached, and on this account practically no supply was furnished to the sprinklers from this source. One line of hose was attached to the steamer connections, but the fire department directed their efforts mainly to preventing the spread of the conflagration to the business and residential districts west and south of the plants, and only the one connection was made. The water pumped in through one of the four steamer connections was wholly inadequate to supply the large number of sprinkler heads which had opened near the exterior walls. The exterior openings on these buildings were unprotected, and as the buildings were seriously exposed to a lumber yard conflagration on those sides, they were soon beyond sprinkler control and were destroyed.

Aided by an open yard on the north and a forty-foot driveway on the west, the department succeeded in checking further progress of the fire in those directions, and by concentrating their efforts on the south side, a portion of that part of the lumber yard was saved.

The water supply available was delivered from one twelve-inch city main, and this supply proved to be inadequate.

It is believed that if the factory and warehouse, which were protected with a standard equipment of automatic sprinklers, had had the openings

in exterior walls protected with metal frames and wired glass, and had the fire department connected lines of hose to all of the steamer connections which had been provided, the warehouse and factory building would have been saved.

Total loss about $1,000,000. Huttig Sash and Door Company, $753,750, loss total; Fathman & Miller, $85,000, loss total; Missouri Stair Company, $117,800, loss total; F. Kraleman, $400, loss total; Mound City Box Company, $5,160, loss total; Koken Iron Company, about $25,000.

Lessons: This fire emphasizes the very serious exposure of high piled lumber and that the fifty-foot space required between high lumber and buildings is insufficient. The fire also shows the necessity for the protection of all openings in exterior walls with standard coverings and the necessity for the distribution of an adequate number of fire hydrants throughout lumber yards.

Summary: Conflagration.

S-11467. June 23, 1911. Tenant Woodworker. This was a four-story brick factory with open joist floors. There was a space between roof and false ceiling of fourth floor forming a concealed space of from one to two feet. This was not sprinklered. The sprinkler system was installed in 1891, and badly overloaded. Heads were Grinnell glass disc, installed in 1903. There were 190 heads per floor. All but twelve heads on the top floor operated during the fire. Heads in the kiln were 212 degrees.

The fourth floor was occupied by a showcase manufacturer. An employee saw smoke issuing from dry kiln in northwest corner. He notified clerk in office, who telephoned alarm, and other office man pulled in alarm from public box in street.

Cause not ascertained, but it apparently started in the dry kiln and immediately worked its way into this concealed space, where it burned between the false ceiling and roof unhampered by sprinklers below. Kiln was fairly well filled with lumber, which the sprinklers could not protect.

No private efforts were made to extinguish fire, due to the dense smoke. Public department responded promptly, three alarms being sent in, and put twenty-six streams on fire. It was very difficult to reach the flames, and firemen did not know of the concealed space. Water supply and pressure said to have been ample. Sprinklers were of no avail in extinguishing fire, but probably prevented floor from burning and fire working downward. The main pipe burst and was shut off when fire was nearly extinguished.

Loss about $25,000.

Lesson: Fire shows the necessity of installing sprinklers in all blind attics and concealed spaces.

Summary: Unsprinklered concealed space allowed fire to burn unhampered.

S-11136. February 8, 1911. Locomotive Works. There was a row of open wood flange fires on the southerly side of No. 23 boiler shop. The fans furnishing the air blast for riveting forges were located on a platform near the easterly flange fire. This fan room was enclosed by corrugated iron on wood joists. There were open blinds in place of the windows, through which the air was taken for the fans. On account of this exposed space, it was necessary to remove the sprinklers over the fans and motor. There were no sprinklers underneath the platform. A spark from one of the fires set fire to the platform and it spread up into the fan room, practically destroying the platform and walls, burning out the motor, belts, and damaging the pulleys, etc. Sprinklers on each side of the fan room, eight in all, opened and the large belts in the bolt shop east of the fan room were damaged. A loss of $1,632 resulted.

Summary: Unsprinklered portions.

Lesson: If this portion had been sprinklered, fire would probably have been extinguished with little loss. Exposed places in main plant, subject to freezing, should have sprinklers placed on a dry pipe system, and maintained at all times.

S-11525. June 3, 1911. Mercantile Risk. This was a brick, seven-story tenant mercantile building, of ordinary joist construction. Ceilings were expanded metal and plaster.

Fire occurred on a Saturday afternoon on the third floor occupied by a wholesale dealer in woolens and men's clothing. There were 70 sprinklers in the room, and 53 opened. They were supplied by a 4,500-gallon pressure tank, giving 93 pounds pressure on heads that operated. There was also a second supply consisting of a gravity tank.

From a subsequent investigation, it appeared that gasolene was hauled into building in five-gallon earthenware jugs, and some of it was poured on floor and then touched off. There was also some gasolene in uncorked jugs scattered around the premises. The investigation resulted in the arrest of several parties connected with the fire. The principal confessed his guilt, was then allowed to go to his home in charge of an officer, where he eluded the officer for a moment and committed suicide.

As nearly as can be ascertained, about twelve sprinklers opened on fourth floor and one on third floor at time of fire and discharged the entire contents of pressure tank (3,000 gallons of water) on floor; the head on third floor was opened by burning gasolene dripping through floor. Fire was practically extinguished by time fire department arrived, but for some unaccountable reason, water stopped flowing at this time; that is, gravity tank did not discharge its water through opened heads. After water stopped running, about forty additional heads opened on fourth floor. All of piping, valves, etc., in connection with system was thoroughly examined and found clear, therefore the valve at base of system in basement, which gave evidence of having been tampered with, must have been closed at just about the time pressure tank was empty, which figures about seven minutes after start of fire, although central station supervisory

record shows that gate valve was not closed until forty-two minutes after receipt of water flow signal. It is possible that somebody may also have tampered with supervisory circuits so that the closing of valve in basement would not send in a signal.

There was very little actual fire damage to building and very little fire damage to contents. There was, however, considerable water damage to both building and contents, amounting in all to $1,946 on building and $19,464 on contents.

If water was maliciously shut off, it fortunately was not done until after sprinkler system had practically extinguished fire.

Summary: Incendiarism.

S-11541. August 8, 1911. Sheet Metal Worker. Fire started on the third floor of main building in a barrel of waste paper and sweepings, said to be due to spontaneous combustion. Burning briskly, it opened two sprinkler heads and operated four thermostats. These thermostats sent an alarm into the central fire station at 10.55 p. m. and the apparatus promptly responded. The wood barrel was found to be burned and the flames had spread up the side of a closet partition, against which the barrel had been placed. This was extinguished with ease by the fire department with one hose stream which was in use for ten minutes. Damage to building, $10; no damage of consequence to contents.

This building was equipped with Walworth heads, and was fairly up-to-date except that the dry valve was an old style Manufacturers (Wood type). There were about 400 heads on the system, which was maintained dry at all times. The valve was connected to a rotary gong and thermostat system. Primary supply was waterworks, giving 55 pounds pressure on the heads that operated. The thermostat system was connected to a bell on the building, one in a nearby dwelling of an employee, and a bell at the station house. The dry valve did not trip, according to the best evidence.

The foreman of the factory was called on the telephone while the fire was in progress, but found the fire had been put out before he reached the building. He soon found out that there was no water coming from the sprinklers and so rushed downstairs. Here he found that the links or weights of the valve had not dropped, although the air gauge was flat. Both gate valves were open. The air pressure had been raised to fifty pounds on night of fire.

The foreman said that he first shut the valves and then put on two new links on sprinklers and hit the valve stem of the air cup valve, tripping the valve. He then turned the water on system for the rest of the night. The owners stated that nothing had been done to the valve after the fire occurred until examined by inspectors.

On removing the cover of the air cup, a rubber gasket was found to have been inserted between the valve and its seat, and particles of rubber still adhered to the seat, the gasket being firmly attached to the valve itself. This valve had not been tripped for a year.

Summary: Apparently a dry valve failure.

S-11499. June 8, 1911. Machine Shop. Building was an old three-story frame structure, open joist construction. Woodwork was very dry and partly rotten.

The sprinklers were the Grinnell metal seat, issue "D," pendant, with excessive spacing. The 1-3-6 pipe schedule was in use. Primary supply was waterworks giving 55 pounds pressure on first floor and 43 pounds on third floor. No alarm service of any kind.

On the first floor close to the wall at the angle in the rear wall, there was a wooden barrel filled with oily iron chips from the lathes. As this material was thrown away, other rubbish, sweepings, etc., were thrown into the barrel. It is believed that this material ignited spontaneously.

The fire was discovered by bakers working in the adjacent bakery. They heard the noise made by the water falling from the sprinklers and notified a policeman. The policeman seeing smoke, pulled in an alarm. The sprinkler immediately over the barrel failed to operate, although the solder started to fuse. One other sprinkler, about twelve feet away, acted in the same manner. Eight heads opened on this floor, which kept the fire close to the wall. About five or six feet along the wall from where the fire started was a hole in the second floor for pipes. Through this hole the fire entered the second story, and staying between the joists it ran up the wall into the third story, opening two heads on the second floor but doing no fire damage. On the third floor four heads opened and the wall framing and roof joists were charred badly over an area of several feet square. Owner reports that the fire seemed to be burning above the sprinklers, the heads being turned down.

A peculiar feature of this fire was the way it passed through the second story. The woodwork of the wall was not charred, but only darkened a little as the fire passed over it.

While the failure of the sprinkler nearest the fire greatly increased the loss by allowing the fire to get into the floors above, it was the sprinkler system that saved the building from complete destruction.

Lesson: Old and unapproved sprinklers should be replaced by approved heads installed in a standard manner.

Summary: Defective sprinklers.

S-11324. January 3, 1911. Furniture Store. Fire started in second building south. Adjoining building was ignited and fire gained great headway. Walls of building collapsed from heat of fire in this adjoining building. Sprinklers were of no avail. Details of fire not reported. Loss total, $160,000.

Summary: Exposure fire.

S-11492. May 8, 1911. Woolen Mill. Fire occurred in a two-story wooden storehouse, thirty by seventy-five feet, of open joist construction. It was located ten feet south of mill, the short dimension of storehouse being parallel with mill. Storehouse was unsprinklered except over a boiler at north end first floor. An unsprinklered passage connected storehouse to sorting room in mill on second story, cut off at mill

end by fair single fire doors. Walls of main mill were stone. First floor of storehouse beyond boiler room used as a carpenter shop; wool storage on second.

Fire started in carpenter shop at 6.15 p. m., probably caused by workman throwing down lighted match after lighting his pipe. Factory closed at 6 p. m. The watchman upon his first round immediately after the mill shut down discovered the fire and gave alarm. Two streams were taken from the private hydrants, and the steamer which responded put on two more, draughting from the river. There were five heads in the sorting room of the main mill and two heads in the boiler room, which operated and probably checked the spread of fire towards the main mill. Storehouse was completely destroyed except the first story of end next to mill containing the boiler. Loss $9,150.

Lesson: All portions of a risk should be protected by automatic sprinklers, or else the unsprinklered portion should be well cut off from the sprinklered.

Summary: Unsprinklered portions.

Miscellaneous Fires.

Interesting fires are given under this heading without regard to their classification.

S-11432. May 9, 1911. Flour Mill. Fire occurred at 6.30 p. m. in the top floor of the smut room, caused by a hot bearing on a scourer in the floor below. The scourer was one of the older type, with the bearing partly inside the machine. The hot bearing was discovered by the workman, and the machine shut down, but before being shut down it must have caused a spark or ignited some dust, which was carried by the fan to a cloth dust collector in the floor above, and the first notice of the fire was from the sprinkler alarm. The fire evidently burned very rapidly at first, and opened all the 19 sprinklers in the room, and it got through the floor above into a small room in the cupola, opening the sprinklers there. In all 23 heads were opened. The pressure on the sprinklers was nine or ten pounds from the tank, and about half the water from the tank was discharged before the necessary valves were opened to bring the pump into operation, after which a pressure of 150 to 200 pounds was maintained at the pump. The sprinklers did excellent service; in fact, they practically extinguished the fire, for although hose streams were used, the fire was so difficult to reach that the streams were of little or no value.

The machine was destroyed, and a little damage was done to the building by fire; most of the damage was by water, to belts, spouts, grain, etc.

The sprinklers were Grinnell issue "D," installed about twenty-three years ago. The spacing was wide, and the pipe sizes were the old Providence Steam and Gas Pipe schedule. This was a dry system, having a four-inch angle check valve under tank. Air pressure in system at time of fire was not stated. There were 685 heads on system. The location of fire was such as to insure the water reaching the fused sprinklers promptly. Loss was about $8,800, and the mill was closed down for about ten days. Loss was less than four per cent of value represented.

Lesson: Although the action of sprinklers was satisfactory, the loss was considerable. The need of an automatic water supply of high pressure was clearly shown.

Summary: Considerable loss due to a faulty method, and consequent tardy action of bringing a water supply of high pressure into use.

H-6644. August 6, 1911. Structural Steel Worker. Plant was of inferior construction, being joist trussed roof. It had a large area, and hazards were poorly guarded. Private protection was totally inadequate, and when watchman discovered fire he had practically no means of fighting it. Watchman had no clock, but said he discovered fire promptly near the rivet heater tower. He had previously noted that the stock from rivet heater was in poor condition. Watchman telephoned the fire department, but they refused to answer the call. Plant was located beyond the corporate limits of the city, and fire department was legally justified in not responding to the alarm, as plant owners had refused to deposit the required small forfeit charged by the city when fire protection is extended to plants beyond the city limits.

Practically a total loss.

Lesson: Watchman should be under check of an approved time recording clock.

If adequate private protection had been provided, it is entirely probable that the fire would have been extinguished in its incipiency.

Plants when located beyond the corporate limits of a city should avail themselves of every opportunity to obtain city protection.

S-11468. June 25, 1911. Tenant Manufacturing. The main portion of this plant was a five story and basement brick building of old plank and timber construction. About ten feet north of this was a one story and basement brick boiler house of joist construction; the main building also extended north at east side and beyond the boiler house which adjoined this wing. Thus the five-story building and boiler house to north formed a small hollow square ten feet wide, the east end of which contained a brick stair tower with a lath and plaster sheathed stairway with one-inch wooden doors at each floor. On top of this brick stair tower was located a frame enclosed tank house containing some small unused house tanks. This tank house was in part corrugated iron-clad.

Buildings and stair were equipped with sprinklers of the Kane bulb root type. Pipe sizes were old schedule. Only supply consisted of a 4,500-gallon gravity tank, giving 14 to 30 pounds pressure on heads that operated.

On the morning of fire there were 24 barrels of straw piled in the east end of the court noted between five-story building and boiler house, apparently against these buildings and also near the west wall of stair tower. All these walls contained unprotected windows. Barrels are described as being about three feet in diameter, and with open slat sides resembling a crate. Straw was said to have been located here for several days.

Fire broke out in this stock of straw, and gaining considerable headway, must have shot up three or four stories, and enough heat reached roof to set fire to sides of wooden tank house, so that two sides of tank house were demolished by the firemen in extinguishing the fire. The heat opened one sprinkler in fourth floor of main building; one in third floor; two in second floor, and three in first floor of this building. Also three sprinklers

in stair tower and six in first floor north building over boiler were opened by the heat, making 16 in all.

These sprinklers did excellent work, and kept fire from entering building, there being scarcely a scorched place inside building, but sprinklers could not extinguish fire in the window frames. Tank is said to have emptied entirely, so that it is probable, had not fire department gotten on the ground in good time, fire would have worked its way into building, and a bad loss would have resulted.

Two or three window sashes on north wall of first floor main building were burned out, two on second floor and one on third floor; on fourth floor one sash was somewhat charred. A window and door in south wall first floor of boiler house were badly charred and almost burned out.

Origin of fire is unknown. Straw in barrels had been lying in this yard for several days, and it is possible a fire had originated here from a match or cigarette butt thrown from window of building or stair tower, and had been smouldering and gathering headway since Saturday afternoon (fire broke out early Sunday morning). Great trouble had been experienced in this property from employees smoking in stair tower.

Loss considerable by water and from leakage.

Lesson: The danger from storage of combustible material in courts and adjacent to buildings is clearly shown. Standard metal frame and wired glass windows would probably have prevented most of the loss. The danger of inadequate primary supplies was forcibly shown; but in this particular case the fire was controlled before this became a factor in the extinguishment.

S-11478. July 7, 1911. Fire from Celluloid. Celluloid was used in connection with bookbinding novelties. There was a row of wooden shelves or racks against brick wall of building. These racks were divided into pockets two feet wide, fifteen inches high and four and a half feet deep. Rack contained six rows of four pockets each. Fronts were open. They were occupied mostly for storage of leather in rolls, but at one end, and in second compartment above floor, there were stored about twenty sheets of celluloid, 20 by 36 inches. There was a thin sheet of paper between each sheet of celluloid.

The factory was in operation when suddenly a muffled roar was heard, and a blaze burst forth from the rack near where the celluloid was stored. In the same enclosure was a large quantity of small celluloid buttons. There were no artificial lights nor heat near the material, and no smoking was done on the premises. The end of the room where fire occurred was occupied by girls. The flame was extensive, and the entire quantity of celluloid was consumed.

The sprinkler equipment operated, and held the burning shelving in check until the arrival of the firemen. The fire was confined to the wood shelving, and some damage was done by water. The joists and floor boards above, in the path of the sheet of flame which shot across the room, were scorched and charred for a space of five feet wide, and extending to wall

across the room a distance of twenty-three feet. Wall was blackened for a small space. This illustrates the intensity of the flame, which lasted only a moment. Two sprinklers opened directly over the rack, three on the next line, eight feet beyond, and two on a line of sprinklers seventeen feet away. A hanging shelf, two and a half feet wide and about four feet in front of racks, slightly obstructed one line of sprinklers. The sprinklers had nearly extinguished fire when firemen arrived. They used hand chemicals and a stream from chemical engine.

The excessive summer heat, which developed a temperature of 100 degrees Fahrenheit in the room, no doubt caused heating in the celluloid which, when once started, was from the nature of the material increased to the point of combustion.

Loss on building slight; on contents $500.

Lesson: Fire shows the intensely combustible nature of celluloid and the necessity of guarding against storage of other than a small quantity outside of specially provided vaults. It has been repeatedly shown that sprinklers can successfully handle a fire in a small quantity of celluloid.

S-11261. April 24, 1911. Pharmaceutical Supplies. This fire occurred in the distilling room on first floor of a basement, four-story brick, joist constructed building. The ceiling of distilling room was wood sheathed, with several small openings to floor above.

The fire was explained as follows: Alcohol was being distilled in a small copper still in the distilling room. The still was steam jacketed, and distillation was done with a vacuum system in order to accomplish the result with moderate temperature in the still. In the upper part of the still were located a fixed glass plate about four inches in diameter, and a removable relief plug about two and a half inches in diameter, which was also fitted with a glass plate. This latter plug simply set into a seat, and was held there, air tight, when the vacuum was created in the still. This plug was not fastened in any way, and its function was to provide a relief for possible excess pressure in the still. Over the other glass plate was located a gas jet, which, when lighted, enabled a man to view the contents of the still through the glass in the relief plug. On the second floor over the distilling room was located a large condensing tank filled with water, in which was a coil of hammered tin pipe, which was connected to the still. During the process of distillation this pipe was, of course, a part of the vacuum system, and was connected to the pumps.

At the time of the fire one of the joints in this submerged pipe gave way, allowed water to get into the pipe, destroyed the vacuum in the system, and prevented proper action of the pumps. The attendant at the still had the gas lighted, and was going through the regular routine when he heard the pumps begin to act badly. He ran out to see what had happened to them. Almost immediately there was a sort of explosion in the still, and the alcohol vapor which came out with a rush through the relief hole was ignited by the open gas jet. The force of the steam from the still was sufficient to carry the burning liquid to the ceiling of the room.

Three sprinklers opened and held fire in check, but for a little that got under the sheathed ceiling. A telephone call was sent to the fire department, and they cut away the floor above and extinguished fire with hand chemical. Superintendent had previously used several chemicals, and could probably have handled fire alone, but department was called as a matter of precaution.

The damage by fire was very slight, mostly surface scorching. The still was badly damaged, the bottom having buldged in when accident occurred, and the still damaged by burning. About ten gallons of alcohol were burned. Damage estimated about $150.

Lesson: Open gas jets should never be used near any machine or process involving volatile and inflammable liquids. The undesirability of sheathed ceilings is also shown. Special processes involving an inherent hazard, with possibilities of explosion, should be cut off from other portions of plant.

Attendant should have shut off the gas as soon as he realized that something had gone wrong, as the orders were strict about this when alcohol or other inflammable liquid was being worked at this plant.

H-6592. July 11, 1911. Crude Oil Receiving Plant. Oil tank was constructed of steel on stone foundation. Tank was not equipped with lightning rods. It was struck by lightning about eight p. m., and was allowed to burn out, although about five thousand barrels of oil were pumped out during fire to an empty tank on premises.

Illustrates vital need of suitable protection against lightning for all tanks of this nature.

H-6671. Oil Refinery. Lightning struck tank full of oil. Burned out, but was confined to one tank. Loss about $30,000.

H-6583. July 20, 1911. Peanut Oil and Butter Factory. This plant comprised a four-story building, with two old buildings annexed. The factory was well equipped with machinery, which was operated by oil engines, the latter being located on the first floor, with oil supply tank outside underground.

A new oil press, to be operated by hydraulic power, had been installed on the first floor, and a test was being made of the compressor by the proprietor with the use of oil. The accumulators were on the first floor, and the pipe from the pump to the accumulators led down through the floor to the cellar, and was carried along the ceiling a distance of about ten feet, then up to the accumulators. The pipe was said to be one inch in diameter, the thickness not being known to the proprietor. A pressure of 4,500 pounds had been reached when a variation in the pressure was noted, and the pump was stopped. Immediately a flash of fire was noticed in the cellar, and, as stated by persons outside, the flame extended out through the open cellar windows. The fire extended up a stairway leading from the cellar, and soon enveloped the entire factory, including the annex buildings, resulting in a complete destruction of buildings and contents.

No work was done in the cellar, but a gas light was kept burning to direct employees when called to that point.

The oil used in the test was said to be a mixture of peanut and mineral; the latter, although not described, was probably petroleum, the object being to prevent gumming.

The wreckage after the fire would not permit access to the building, but from facts learned in the investigation, it is possible that the fall of pressure indicated a leak in the piping in the cellar, and the oil under such pressure would become heated to its ignition point, and escaping in the form of spray would be ignited by the open gas flame located near the pipe in the cellar, at which point the fire was first seen.

Loss practically total, $37,000.

H-6542. June 11, 1911. Box Shook Factory. This was a two-story wooden mill of heavy joist construction. Stairway openings were not enclosed. Boiler house was brick, cut off from factory by a blank brick wall, but wall was not parapetted.

The only exposure was from a main line railroad track passing fairly close to factory on the west side. Lumber yards adjacent to property were more than fifty feet from factory. Plant was occupied for the manufacture of wooden box shooks, the hazards being those usual to this class; viz., sawing long lumber, planing, stacking the completed shooks, and some glueing.

There was a night watchman on the premises the night of the fire, and he claimed to have passed the west side of the building fifteen minutes before fire was discovered. The fire, however, was actually discovered by some railroad men passing along the west side of the building, returning from

their work. There was no actual evidence how the fire originated, but presumably it caught from a spark from locomotive, as a train had passed about fifteen minutes before discovery of fire. In stopping at the station, if train was of ordinary length, the locomotive would be brought just about opposite this mill. In starting the train, there was naturally an unusual amount of heavy cinders from the locomotive, and these, if the wind were right, would fall directly on the mill. About ten years ago this mill was burned in apparently the same manner, and it was the general impression that this fire must have originated from a spark from locomotive.

The city fire department responded promptly but the water pressure was not good. Luckily there was very little wind and the lumber yards adjacent to the property were saved, but the factory and contents were a total loss. The building was not sprinklered and had no automatic fire alarm system of any sort.

Lesson: Factory property near railroads should have brick walls and fire-resistive roofing.

H-6682. Moving Picture Exhibition Hall. A piece of film broke during exposure. The end of the piece of film flopped over on the lantern box and was ignited, causing a flash which was observed by the audience. The burning piece of film did not extend into the magazines. As carry-off pipes were required to be attached to all booths, a slight smoke escaped to the outside. This being observed in the street, caused an alarm, but the audience remained until a new reel was introduced and the exhibition continued. No panic occurred and there was no loss.

Our member reports three fires at different locations of a similar nature. In each case the fire was confined to the booth, and the flue from the booth to the outside carried all smoke from the auditorium. There was no panic from any of these occurrences.

S-11508. July 14, 1911. Shoe Factory. Factory was a four-story, wooden building of open joist construction, sprinklered inside. The south side of factory was protected from exposing building by two lines of open sprinklers on third and fourth floors over windows. Heads were about eight feet apart on 1-2-4 schedule and one-half-inch orifice. Supply was from a six-inch automatic sprinkler connection from a ten-inch main at sixty-five pounds pressure.

Eight feet south of this factory was located a three-story frame metal-clad building, used as a blacksmith shop on the first floor, hay storage in the basement, and carriage storage and paint shop on second and third floors. The fire started in this building from unknown cause and spread quickly to the stable west of it. The stable was about half destroyed and the building in which the fire started totally destroyed.

The fire department was called as soon as the fire started, but owing to another fire fifteen minutes previous, they were delayed sometime and let the fire get considerable headway before getting water on. The fire progressed so rapidly that assistance from outside towns was asked.

Fire was kept out of the factory entirely by the open sprinklers, pails and extinguishers. The **open sprinklers did excellent work until the steamers reduced the pressure** and then pails, etc., were used to good advantage by employees of shoe factory. The engineer at factory, fearing that fire might get into same, opened about sixteen heads near windows on the third and fourth floors. This probably caused more damage than was absolutely necessary. All fire damage was done to window sashes, cornice, etc., on the outside of the building, while considerable damage was done inside by water.

Lesson: The effective protection afforded a wooden factory from a severe exposure fire by a good system of outside sprinklers was clearly shown. However, the need of ample water to attain such protection, and the futility of such protection where the mains and pressure is not adequate, was also demonstrated by the effect on the open sprinkler system produced by the draught of the steamers.

This fire raises the question whether or not the contention of certain fire protection engineers, that open sprinkler supplies should be under control of the building occupant, is justified. Similar demonstrations have led them to consider the advisability of connecting open sprinklers to secondary water supplies, whether pumps or gravity tanks.

S-11155. June 16, 1911. Sash and Door Factory. Fire originated from some unknown cause in an empty freight car on switch track under frame awning south side of warehouse building, and when discovered had gained considerable headway within the car.

Warehouse was a basement and two-story brick building, 139 by 250 feet, and was not equipped with sprinklers; open joist construction, windows not protected. Outside on south side there was a frame covered platform, and on the north side there was a frame wood awning.

A fairly strong wind from the south blew the flames from the burning box car directly into the warehouse, and the warehouse was soon thoroughly afire upon all floors. The warehouse was well filled with finished doors and sashes. The lumber, piled in lumber yard located fifty feet north of the warehouse, was soon ignited from the fire in warehouse, and fire got beyond control of the fire department. The fire was confined, however, to the warehouse and lumber yard, and there were no buildings immediately north which were exposed by the lumber.

The factory building, situated fifteen feet west of the warehouse, was protected by a standard dry pipe automatic sprinkler equipment. Supplies consisted of a one-inch city connection taken from a six-inch city main, pressure fifty pounds; and two four-inch steamer connections. Alarm service extended through central station to engine company. There was a night watchman with signal boxes.

The burning of the lumber piles fifty feet north of the factory building ignited the wood window frames and the exterior openings in north wall. Forty-nine sprinkler heads opened near the exterior walls and these sprinklers were supplied, in addition to the six-inch connection from the city mains, by two two and one-half inch hose connections by the fire department. The sprinklers, with the metal frames in the east wall of the building, prevented any fire loss within the factory building, with the exception of the burning of the window frames in the openings of north wall of building and a small opening in the northeast part of roof. Loss in sprinklered portion small; large loss in unsprinklered portions and lumber yard.

Lesson: The danger of exposing unsprinklered buildings and lumber piles to other buildings is shown. The sprinklers were very effective in keeping the fire from entering the factory.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

S–11352. Plate Glass Works. Gas jet in dry valve cabinet was turned on too strong by workmen. The sprinkler from below dry valve operated and extinguished fire.

Open gas jets should not be placed in close proximity to automatic sprinklers.

S–11358. Automobile Factory. Workman washing hands in gasolene, used lantern to see by.

Open flame lights should never be used near gasolene or other volatile materials.

S–11362. Cotton Yarn Mill. Boy wheeled truck over match. A flash fire resulted, which spread to mule frame.

S–11364. Cotton Yarn Mill. Employee opening a bale of cotton, stepped on a parlor match. Four sprinklers opened. Loss about $400,000.

Cotton mill employees should be provided with safety matches, and no others allowed.

S–11370. Shoe Factory. Employee was filling small cans at treeing machines from a five-gallon can of naphtha. There was a pair of electric wires cut off which were alive. Can made short circuit, and naphtha was ignited. Six sprinklers opened, causing a water damage of $2,277.50.

Main supply of naphtha should be kept in a detached house. Small cans should be filled there instead of in the factory.

S–11382. Printing and Lithographing Establishment. Engineer was locating a gas leak with a match. He found it. Result,—one head opened and extinguished fire.

S–8943. Bakery. After a gas pipe had been extended and the gas turned on, employee thought there was a leak, and went to look for it with a lighted candle. He found the leak, and was taken to the hospital badly burned.

Gas leaks should be sought with pocket electric flash-lights.

S–11482. Planing Mill. Spontaneous combustion of damp coal in the boiler room communicated through a pipe opening into the shavings house, where a sprinkler opened and extinguished fire.

Shavings houses should be well cut off from boiler rooms.

S-11490. Clothing Manufacturing. Electric flat iron was left with current turned on, resting on a cloth-covered wooden pressing table. Iron was provided with pilot light, which apparently was burning when shop was shut down. Fire partly consumed two wooden pressing tables.

Danger signals are useless unless it is the duty of some responsible person to make an inspection of work rooms after employees have left.

S-11293. Woolen Mill. A sheet of clean roving waste was placed so that it was in contact with the end of a wooden shelf saturated with a mixture of oils, principally lard oil. It was also in contact with a small steam pipe close to end of shelf. Waste was placed here between 11 a. m. and 12 noon on Saturday, and mill closed at noon. Mechanic in other part of mill smelled smoke about 4 p. m., traced it to card room and found two sprinklers running and fire extinguished.

This fire demonstrates how readily cotton waste will ignite spontaneously when in contact with oil and assisted by heat.

S-11287. Wholesale Grocery. Boards used to cover up hole in chimney caught fire from sparks.

S-11312. Shoe Leather Warehouse. Kerosene oil lamp used for heating dry valve cabinet started fire in cabinet.

Dry valve cabinets should be heated by steam or electric lamps.

S-11346. Rubber Mill. While employee was cleaning off board and making repairs, he struck a spark on a nail, which set fire to the fumes from naphtha nearby.

S-11256. Celluloid Worker. One of several pieces of celluloid being warmed was left on steam table too long and burst into flame.

Shows the great care needed in working and handling this dangerous material.

S-11512. Box Shook Mill. One of several fires occurring in this plant from a hot bearing in a mule pulley stand in shafting basement.

Points out the need of giving proper care to bearings, especially where the load is excessive and the location obscure.

S-11485. Warehouse. Boys lighted a bird's nest and threw it through a window on first floor, where baled sisal was stored, causing a fire sufficient to open nine sprinklers and do over $7,500 worth of damage to stock.

S-11442. Cotton Mill. Imperfect insulation of wires in lamp socket caused arc which set fire to lint on drop cord.

S-11445. Paper Box Factory. Supposed to have been caused by mice gnawing matches in drawer of office desk.

Only safety matches should be used.

H-6598. Broom and Mop Factory. Fire supposed to have been started by burglar who entered office and attempted to rob safe, as knob and hinges were found broken off of safe, and several other plants in neighborhood were entered the same night.

H-6265. Woolen Mill. Oil in barrel directly over steam feed casing saturated casing and contents, and as a result of this oil and heat, the casing caught fire.

S-11247. Metal Worker. A swinging gas jet near japan table was swung too near the japan and ignited the vapor.

Open flames should never be used near volatile inflammables. Use electric lights with double-enclosed globes.

H-6503. Garbage Reduction Plant. An explosion occurred in dryer, supposed to have been due to dust, causing a loss of seventy-five per cent to building and fifty per cent to contents.

H-6685. Ladies' Straw and Felt Hat Factory. Fire supposed to have been due to match thrown into basement by persons passing by. Fire occurred on the evening of "Civic Holiday."

Areas, windows, doorways and all wall openings into buildings or yards should be securely closed when premises are vacated for the day.

H-6688. A second fire was due to the fact that the first fire had not been properly extinguished.

S-11524. Wholesale Drug and Chemical House. An explosion occurred near some celluloid and fibre trays, immediately followed by flames which burst out from the shelves containing the trays.

H-6624. Saw Mill. Total loss from exposing forest fire. This fire had been burning in the brush for days, but was not regarded as threatening. After a long period of hot weather and drought, a gale sprung up which drove this fire right upon the mill. Part of the village was burned as well.

This catastrophe was due to criminal negligence in permitting the forest fire to burn unguarded and without pursuing proper methods to extinguish it.

H-6683. Metal Worker. Fire occurred on roof during a heavy rain. At time of discovery there was a pretty electrical display just in the act of setting fire to the roof timber. Evidently careless employees, who were erecting a building adjoining, allowed a piece of wood to fall and remain across the electric wires, thus giving a good chance for wind, friction and rain to cause a fire.

Some responsible person should always be on guard against the careless acts of workmen.

S-11528. Wholesale Grocery. A fire was built on the ledge of rear sub-basement window by boys after business hours on Saturday afternoon.

A heavy galvanized wire netting was afterwards placed over these windows.

H-6700. Metal Worker. An unprotected gas jet was turned against the wall, setting fire to paint and a calendar hanging on the wall.

Swinging gas jets should always be provided with wire guards.

H-6693. Dry Cleaning Establishment. Employee was wringing out a silk garment that had been washed, when the saturated grease took fire and ignited the gasolene in the copper basin The employee was burned by the flash, and fire spread rapidly over the room.

S-11537. Shoe Factory. A Fourth of July fire. A sky rocket landed on the roof and set fire to the shingles.

This is a constant danger, so long as shingles are in general use.

H-6677. Sparks from a bonfire built by boys.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Alarm Service.

S-11240. Shoe Factory. Fire occurred just before the watchman's round. Thermostat sent in alarm and fire department responded before watchman was aware of the trouble. Fire was extinguished by chemical stream before sprinklers opened.

Value of reliable automatic alarm service clearly demonstrated.

S-11250. Shoe Factory. Fire occurred in a closet. Sprinkler directly overhead with deflector eleven inches from ceiling. Nearest thermostat was on the ceiling and three feet away. It failed to operate. Alarm was transmitted by alarm valve.

Thermostats should be located at every sprinkler head according to rule.

S-11497. Shoe Factory. Fire started in a small office containing two sprinklers and one thermostat. Sprinkler system was provided with alarm valve connected to outside rotary gong. Both thermostat and rotary alarm failed to operate. One sprinkler extinguished fire and operated for fifteen minutes, doing considerable damage before it was discovered.

Investigation developed the fact that office had been recently remodelled and sheathed. The circuit wire to the thermostat had been disconnected from one of the binding posts and allowed to remain in this condition. Alarm valve had not received the proper care and tests that it should.

This shows the necessity of careful inspection and testing of automatic alarm devices.

H-6690. Foundry. Fire discovered by engineer at 2.40 p. m. on Saturday. Regular watchman usually punched boxes Saturday afternoons, but was having a half holiday. Temporary watchman not familiar with box locations, but said to have made rounds regularly.

All reserve or temporary watchmen should be thoroughly instructed in their duties before being intrusted with this important work.

S-11533. Tenant Manufacturing. An alarm valve, without retarding chamber, was connected to a six-inch vibrator bell. It failed to operate. This was a tenant property of a class subject to large water damage.

Properties of this nature should have approved connection with central station from sprinkler alarm. They should be provided with an approved thermostat system with central station connection or have standard watchman's service.

H-6673. Silk Mill. Had dogs in building in lieu of watchman, but failed to put dogs in on night of fire.

H-6650. Grain Elevator. Fire had apparently burned for some time before discovery by outsider. No watchman service. Fire had too much headway and plant was destroyed.

A watchman might have discovered it in time to save the plant from total destruction.

S-11529. Tenant Mercantile and Light Manufacturing. Notification of fire given by alarm valve connected to National District Telegraph.

S-11521. Light Manufacturing. Central station sprinkler supervisory water flow signal, followed by low air and water signals from pressure tanks, received at central office at 10.26 p. m., and runner sent to risk. Fire department was notified and responded promptly, but was not needed, as one sprinkler had completely extinguished the fire. Gate valve closed, signal received at 10.32 p. m. Sprinkler head replaced by runner, and gate valve opened at 10.52 p. m. Pressure tank restored to normal condition at 2.50 a. m.

This demonstrates the value of a supervisory system connecting the fire appliances with a central station.

Automatic Sprinkler Systems.

Corroded Heads.

S-11288. Planing Mill. A fire starting in sprinklered shavings vault entered mill and 27 sprinklers were opened in all, holding fire in check, which was finally extinguished by the fire department. Part of equipment consisted of old Neracher heads which were badly corroded and were probably slow to operate. Two heads failed to open at all.

Corroded heads should be replaced at once; also all old heads not now approved.

Dry Systems.

S-11297. Woodworker. About 700 heads on dry valve with 30 pounds air pressure. There were 250 heads in room and twelve opened. Action of dry valve slow, due to overloaded dry-pipe system.

S-11312. Shoe Leather Warehouse. Kerosene oil lamp used for heating dry valve cabinet set fire to same, opening the wet sprinkler in cabinet supplied from below the dry valve.

Dry valve cabinets should be carefully insulated from the cold and be accessible to the sun's rays if possible, to prevent freezing and avoid the necessity of artificial heat. If heat is necessary, no open flames should be used.

Efficacy of Sprinklers.

S-11268. Cotton Twine Factory. Fire occurred in waste cleaning machine. It was getting away from the men who were using chemical extinguishers and pails, when two sprinklers opened and practically extinguished fire.

Gate Valves.

S-11251. Shirt Waist Factory. It was claimed that there was difficulty in turning off the water, which caused excessive water damage on the various floors. A small fire, extinguished by four heads, caused damage of over $10,000.

Conspicuously posted signs should show location of sprinkler valves and portions of system controlled by each. Careful inspection of all valves should be made.

Obstruction to Distribution.

S-11250. Shoe Factory. Fire occurred in a closet, eight feet high, in center of room. Top had been removed, but at time of fire there was a heavy linoleum covering over opening. This covering prevented sprinklers from entirely extinguishing fire.

Closets should have their tops removed, and be covered only with a wire screen or cheese-cloth. This procedure can be of no benefit, however, unless the top of the closet is kept clear of storage.

S-11281. Ladies' Straw and Felt Hat Factory. Sprinklers held fire in check, but double sheathing, about four feet wide, prevented them from entirely extinguishing it.

Concealed spaces and sheathing always offer serious obstructions to effective sprinkler control.

Water Shut Off Too Soon.

S-11408. Cotton Mill. Fire spread over six bales of loose cotton. Superintendent thought fire was practically out, and shut off sprinklers, attempting to handle the cotton. Fire broke out in a blaze, and before water could be turned on again, cotton was nearly destroyed.

S-11500. Shoe Factory. Watchman while making his rounds found fire in a bale of sweepings and used three chemical extinguishers, and apparently extinguished fire, as he thought. He then continued on his round, and upon reaching the same place again he found a blaze well started and five sprinklers in operation.

After a fire has apparently been extinguished, it should be carefully investigated and the locality watched until all uncertainty of the result has been removed. Sprinklers should never be shut off until this has been done.

Construction.

H-6636. Garbage Crematory. Fire was caused by furnace exposing wood partitions in a well-constructed building of brick walls and heavy open joist roof.

Structures to be used as reduction plants should be entirely free from combustible material, and should be of strictly fireproof construction.

S-11527. Metal Worker. A japan drying oven rested on a three-inch cement floor laid directly on the wooden floor. Heat from oven penetrated the cement and set fire to the floor.

H-6653. Mattress Factory. Fire occurring on first floor immediately communicated to second floor through an open elevator shaft. The second floor shafting fell, pulling down a parapetted wall and with it the roof of an adjacent building. Fire gutted the second floor of adjacent building, although it was cut off by fire doors and an apparently standard division wall.

Avoid open elevator shafts. This fundamental defect rendered ineffective the protection which would otherwise have been afforded by the good division wall between the buildings.

H-6662. Furniture Factory. Tank roof covering composed of wooden shingles. Boilers at time of fire were using wood shavings, etc. Sparks from stack ignited the shingle roof on two occasions.

Inflammable roof coverings should not be used on tanks or elsewhere and especially in manufacturing plants where wood refuse is used at times for fuel.

S-11288. Planing Mill. Partially boarded up openings in brick walls of shavings vault allowed sparks from boiler stack to enter and start a serious fire.

Brick walls of rooms with combustible contents should be kept free from openings and in good repair.

Fire Doors.

H-6687. Mercantile. A destructive fire occurred in building No. 279. Fire doors protected openings into building No. 281 and kept fire from that building. Only a slight damage to the property and contents.

Shows the value of standard automatic fire doors.

Heavy Losses.

S-11251. Shirt Waist Factory. A small fire opening only four sprinklers in a room of thirteen heads caused a water loss of nearly $11,000.

S-11506. Wholesale Drug House. A fire from unknown cause started on top floor used for storage of herbs in barrels and bags. Two sprinklers operated and extinguished fire in less than twenty minutes. There was a water loss of about $3,000.

These fires show the susceptibility of certain classes of stock to heavy water damage as result of a trifling fire.

S-11409. Cotton Mill. Water did not penetrate open cotton freely. Fire continued to burn beneath wet surface of the pile and a large loss resulted.

Inside Protection.

S-11256. Celluloid Worker. There was a large amount of celluloid no long bench before which several girls were at work. The fire did no

more than burn the one piece of celluloid which had been ignited and the paper on which it lay. One pail of water, which one of the nearby employees threw on the fire, extinguished the flame before the fire had attained sufficient proportions to open a sprinkler, and five minutes later the girls were back at work and showed no signs of excitement.

This was a very practical demonstration of the great value and efficiency of fire pails properly distributed in all classes of risk.

S-11531. Men's Furnishings. Fire was extinguished before heat was sufficient to open sprinkler head, by porters and engineer, who used three streams from standpipe and three chemical extinguishers.

Stand pipe and chemical extinguishers may often be of great value in extinguishing fires in their incipiency, and thus save a greater water loss.

Management and Housekeeping.

H-6632. Mercantile. Fire occurred in the crockery storage room in the packing material.

Straw and trash should be removed daily.

H-5596. Harness and Fancy Leather Works. This fire occurred in a rubbish heap in the cellar. It is supposed to have originated from employees smoking.

Keep basements clean. Do not allow rubbish to collect in low and dark places. Prohibit smoking.

S-11236. Metal Worker. Fire demonstrated the dangerous practice of allowing dirty paper and oily material to collect in combustible boxes.

H-6548. Cement Mill. During an electrical storm this building of frame joist construction, containing empty cement bags, was struck by lightning. Building was provided with hose connections supplied by a pump. Two lines of hose were laid. There was a limited supply and in poor condition. A couple of breaks occurred at the pump when started. Alarm was sounded by blowing factory whistle. An engine and chemical responded. It was then discovered that department hose would not fit connections at plant. By that time the fire had gained such headway that chemical engine was of little use.

Improper management and lack of interest in protective devices is the lesson of this fire.

S-11349. Furniture Factory. Fire occurred at midnight. It burst out in a heater room when the night fireman entered room. He immediately closed the door again, fastened it, and then called the fire department. When they arrived they found that the six sprinklers in room had operated and extinguished the fire. The fireman then shut off the water, replaced the extra heads from the supply of extra heads on hand, set the dry valve, pumped the system full of air and removed the water from the room.

This was a good example of a well posted and efficient night man.

Patrol and Salvage Work.

S-11529. Tenant Mercantile and Light Manufacturing. Four sprinklers opened on fourth floor and promptly extinguished fire. Fire patrol on arriving shut off the sprinkler system on this floor, and water remained shut off all night. The fused heads were replaced in the morning by men in charge of building.

Fire patrol should be provided with sprinkler heads in order to put sprinkler system again in commission as soon as possible.

S-11524. Wholesale Drug and Chemical House. A man responded to alarm at central station and arrived before the fire department. He found that four sprinklers had practically extinguished a fire on the second floor. As soon as the fire was out, he closed the sprinkler valve and opened the drain valve, and thereby prevented a much greater water loss. Office furniture, etc., was covered with tarpaulins. Water on floor was swept out and soaked up with sawdust. The sprinkler heads were replaced immediately and the system put in commission.

H-6701. Foundry. The patterns were thoroughly wet down, but the loss to these was considerably reduced by assured's good judgment in caring for them at once before they became water soaked.

S-11538. Shoe Factory. Considerable water damage could have been prevented if the fire department had been equipped with rubber blankets. When they arrived at the fire the superintendent asked for covers to spread, and they had none.

Shutters.

S-11507. Printing and Bookbinding. A large frame livery stable, located 25 feet distant was totally destroyed by fire. All openings in the south wall of printing and binding plant were protected by fair wood metal-clad shutters. These were closed at the start of the fire, and by wetting them down occasionally with hose streams, the fire was prevented from entering building. Although the shutters were damaged and have been removed, they did their proper duty.

This fire very forcibly shows the value of proper window protection against serious exposures.

S-11164. Woodworker. Serious exposure fire to building which was provided with shutters. These were not all closed when fire started in the exposure, and firemen found difficulty in closing them on account of racks and other material piled up against the windows inside of building.

Shutters should always be closed each night for protection and to demonstrate they are not obstructed.

Protection Against Exposure.

H-6305. Mercantile. Fire started in adjoining building. Window openings were closed with boards. Most of the loss would have been avoided had these openings been closed with brick or provided with standard shutters.

Standard Rules and Requirements

PUBLISHED BY THE

National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION

A copy of each revised edition of these pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1910
Coal Gas Producers (pressure and suction systems)	1908
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Nitro-Cellulose Films (storage and handling)	1910
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Oxy-Acetylene Heating and Welding Apparatus	1910
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1911
Skylights	1906
Sprinkler Equipments automatic and open systems	1910
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements (standard mill construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1911
Valves, Indicator Posts and Hydrants, for mill yard use	1910
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	June, 1911

NOTE: **Special lists** of Fire Appliances, Devices and Materials, and Gas, Oil and Chemical Appliances, examined and tested by Underwriters' Laboratories, Inc., under the above standards and deemed suitable for use, are mailed to members semi-annually in January and July.